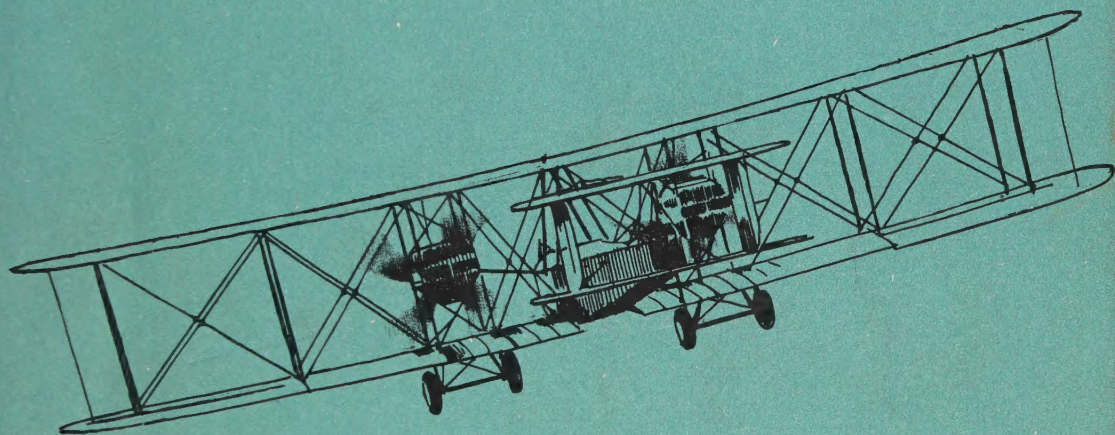


OUR TRANSATLANTIC FLIGHT



**SIR JOHN ALCOCK
and
SIR ARTHUR WHITTEN BROWN**

Now first published in volume form

The first to fly the Atlantic non-stop, John Alcock and Arthur Whitten Brown accomplished their historic flight fifty years ago in June, 1919, to win the £10,000 offered by Lord Northcliffe six years before. Convinced by their experience in World War I, Captain Alcock and Lieutenant Whitten Brown were sure a British aircraft existed already capable of the long and hazardous flight: the Vickers Vimy biplane, powered by Rolls-Royce engines, triumphantly vindicated their belief.

Pioneers of a crossing which rapidly became one of the world's busiest air-routes, *Our Transatlantic Flight* tells in their own words how Alcock and Brown faced the difficulties and perils of their flight—a feat which was not to be repeated for eight years; a contemporary and authentic record of a great achievement.

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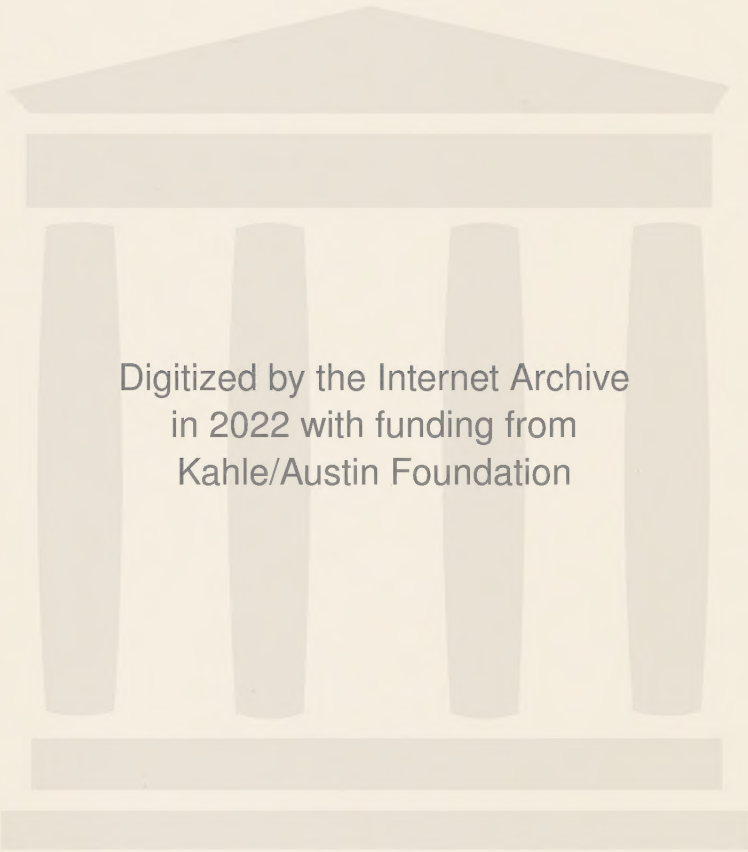
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OUR TRANSATLANTIC FLIGHT

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OUR TRANSATLANTIC FLIGHT

Sir John Alcock
&
Sir Arthur Whitten Brown

WITH AN INTRODUCTION BY
CAPTAIN JOHN ALCOCK

WILLIAM KIMBER • LONDON

First published in 1969 by
WILLIAM KIMBER AND CO. LIMITED
6 Queen Anne's Gate, London, S.W.1

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Standard Book Number
SBN 7183 0221 4

Made and printed in Great Britain by
W & J Mackay & Co. Ltd, Chatham, Kent

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Publishers' Note

Before its inclusion in this book Sir John Alcock's account of his transatlantic flight was published only in the September issue of the *Badminton Magazine* of 1919. A few months later he was dead. Alcock was scheduled to demonstrate the 'Viking', a prototype Vickers amphibian, at an aeronautical show in Paris. On the 18th December 1919, he took off alone in thick fog from Brooklands—in spite of adverse weather reports for the whole journey ahead; the show was due to open the following day. The fog worsened and Alcock got lost over Northern France. Coming down to ground level to try and check his position, with visibility almost nil, the Viking crashed and Alcock died shortly afterwards.

The article is therefore Alcock's only account of his great adventure, apart from a few statements to the press; some extracts from these, where they add to his own account, have been included in Part III of this volume.

Sir Arthur Whitten Brown's account, 'Flying the Atlantic in Sixteen Hours' (for which he received editorial assistance from the late Mr. Alan Bott), was published in 1920 in instalments in the *Royal Air Force and Civil Aviation Record* and this remained the only form in which it was published in this country.

Captain John Alcock, who has contributed the Introduction and also Part III, is the younger brother of Sir John Alcock—who in fact inspired him to fly. He is particularly qualified to write about the epic flight of Alcock and Brown, not only as Alcock's brother, but as a distinguished flyer in his own right. He holds the world record for flying hours as a pilot. In the R.A.F. and with B.O.A.C. he has logged a grand total of 24,500 hours, representing a distance of 5,500,000 miles flown and this was achieved in forty years of flying. Captain Alcock flew in the R.A.F. as a fighter pilot, bomber pilot and instructor; he took part in the pioneer survey work over the Transjordanian deserts in 1928; he carried the first air mails from Britain to Australia in 1931; in 1941 he flew one of the un-

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armed Sunderland flying boats which rescued British troops from Crete; after the Second World War he served once again as an instructor and only retired from active flying in 1957.

Part IV, 'Earlier Venture', is Harry Hawker's account of his gallant attempt to fly the Atlantic just a few weeks before Alcock and Brown. The flight of Hawker and his navigator, Commander Kenneth Mackenzie Grieve, ranks as a landmark in Atlantic flight second only to that of Alcock and Brown; for this reason it seems to deserve a place in the present volume.

Hawker's story is taken from the book *Our Atlantic Attempt* by H. G. Hawker and K. Mackenzie Grieve, published in 1919 by Messrs. Methuen and Company, Limited; it is reproduced here by kind permission of the publishers.

Introduction

by Captain John Alcock

Introduction

It is now fifty years since the first aircraft crossed the Atlantic in a direct, non-stop flight, an historical flight which opened up unbelievable fields for commercial transport and the flying of regular scheduled services between the United States and England with large loads of mail, freight and passengers. These flights might not have been possible had it not been for the successful first flight by my brother, Captain Sir John Alcock, and his companion and navigator, Sir Arthur Whitten Brown.

It was on Sunday 15th June 1919 at 09.25 hours (British Summer Time) when my brother flew his biplane over Clifden, County Galway, Ireland. He had left St. John's, Newfoundland, at 5.28 p.m. the previous day. For the first time in the history of aviation the Atlantic had been crossed in direct, non-stop flight in the record time of 15 hours, 57 minutes.

The flight was a triumph for British aviation; the pilot and navigator were both British, the aircraft was a Vickers Vimy and the twin engines were made by Rolls-Royce. The flight was accomplished in the face of bad conditions—a low depression extending between the United States and England. The machine flew through fog and sleet; at times it reached a height of 12,000 feet in thick cloud banks, and at times it skimmed barely a few feet above the water. The aircraft and its gallant crew battled along and when they finally crossed the Irish coast they had flown over 1,800 miles of rough Atlantic waters at an average speed of 116 miles per hour.

When the people of the world read about the successful flight in their newspapers, millions of them refused to believe that such a miracle of flight had been accomplished. Only ten years had passed since Farman had flown some 40 or 50 miles in straight flight. Hubert Latham had failed to fly the English Channel with his *Antoinette VII*. And then, in 1909, success came to another

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French pioneer when Louis Bleriot made the first crossing of the English Channel in his tiny monoplane with a wingspan of only fourteen feet and powered by a small air-cooled engine which only rated 25 h.p.—a toy-like machine compared to the Concorde with engines producing over 58,000 h.p. Again this type of engine could not be guaranteed to run for more than 30 to 40 minutes so that it was obvious that the flight was a very risky adventure indeed. Bleriot took off from Calais early on the morning of the 25th July 1909 for his famous flight and landed safely at Castle Hill, Dover, 32 minutes later. His flight won him £1,000 put up by the *Daily Mail*. This flight was later improved upon by the Hon. C. S. Rolls who became the first man to fly from Dover to Calais and back again to Dover.

All this was largely made possible through the foresight of one man, Lord Northcliffe of the *Daily Mail*. His paper put up the prize of £100 won by Farman for the first flight of a quarter of a mile outward and back again; they had offered £1,000 for the first cross-Channel flight which had been won by Bleriot; over the next few years they continued to offer substantial prizes for ever-increasing distances flown. The project of the Atlantic flight, which was originated by Lord Northcliffe, was made public in the *Daily Mail* on 1st April 1913 when the prize of £10,000 was offered.

In order that the flight should be a direct one a time limit of 72 hours was fixed; no flight by way either of the Azores or of Greenland was contemplated in the original scheme. The prize was suspended at the outbreak of war but was revived last July to stimulate the production of more powerful engines and more suitable aircraft.

In 1913 there did not seem to be any likelihood that the prize would ever be won and it was not until 1919, during the post-war years of aviation and after aircraft and engine design had been improved due to war experience, that the feat of flying the Atlantic could be seriously entertained.

Nothing was known in those days of existing weather conditions in mid-Atlantic, except that they were subjected to rapid

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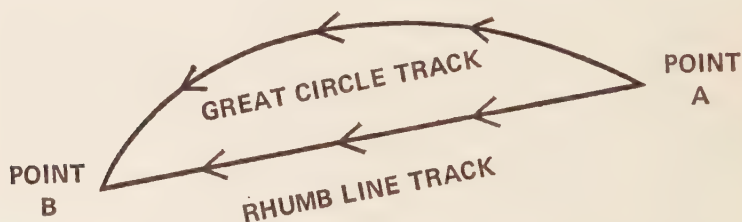
changes; they were certainly an unknown quantity, with violent storms in mid-Atlantic and ice conditions which could force aircraft down, or even cause engine failure. On leaving the United States an aircraft would have to fly over the icefloes and the Grand Banks which are noted for fog conditions, making flying and possible forced-landing hazardous in the extreme. The Grand Banks' fogs are known to exist from sea level up to 3,000 feet.

Today weather forecasting and the preparation of weather charts from known data by meteorologists over a number of years have made present-day Atlantic flying very simple and less speculative than in the days of Alcock and Brown. The collection and mapping of accurate weather data has been perfected to a marvellous degree. It was not until the years 1925 and 1926 that the experts in meteorology realised how important observations made by the captains of steamships in all parts of the Atlantic could be to airmen. Only then was an international organisation formed to collect this data. The captains of ships familiarised themselves with the formulae and codes used by meteorologists and radio men; standard observations with a simple code were used which could be translated into any language for the use of pilots or navigators of aircraft. Today the weather information and the radio beam system combine to allow flying crews to make what we call a pre-flight plan; included in this is the checking of courses on Great Circles when flying over long stretches of water, the best height to fly to avoid ice and to obtain the best wind conditions, and the working out as accurately as possible of an estimated time of arrival. If these conditions had existed in the early days of Atlantic flying many a foolhardy flight would have been avoided and many lives saved.

A 'Great Circle route' perhaps needs some explanation; the easiest system is for a navigator to follow a straight line on a map—this is known as laying off a track on a Rhumb Line—but it does not make any allowance for the fact that the world, unlike a map, is not flat. The shortest route is that following the Great Circle

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track, but this is more complicated and would only make a significant saving in mileage on a very long over-sea flight. To take an example, if an aircraft leaves an airfield in the north of Scotland for a point 500 miles to the east and on the same latitude as the point of departure, then the Great Circle track is 083° True at first, but curves at the rate of 1° every 35 miles until the track comes round to 097° ; the Rhumb Line track runs straight along the Parallel—that is 090° True for the whole trip. The Rhumb Line track would only be about a mile longer and no changes of course would be required; for this reason, a Rhumb Line is used for distances of up to a thousand miles. When you get up to distances of three or four thousand miles, the Great Circle track is used, because there is a saving of miles when sailing north to south or vice versa, between Prime Meridians and Lines of Latitude—but, of course, it still involves frequent changes of course to maintain constant track.



In the days of my brother and Brown, forecasting was based on a very unreliable data; even the number of possible flying days per year had not been ascertained. For the lone flyer the summer months are favourable for Atlantic attempts. A good moon is useful but that limits the flying days to six days a month. Violent storms rule out the winter months, therefore confining flight to the period between May and September. Present-day aids to navigation and the use of four-engined aircraft have enabled British Overseas Airways, Pan American Airways and the other major companies to fly their services all the year round.

But apart from inclement weather the Atlantic had other risks for the flyer who would brave its waters—the risk of ice formation



Captain Alcock and Lieutenant Whitten Brown standing by the Vickers Vimy selected for the Atlantic attempt with members of the Vickers Company at Weybridge.



V. Black

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on the leading edges of wings, tailplane, elevator, aileron controls and propeller were usually encountered in wet fog conditions with a temperature of 28 to 35 degrees Fahrenheit. Violent vertical currents in the vicinity of electrical storms were another danger, imposing as they do a heavy strain on heavily loaded aircraft and causing potential disaster by changing the loads on the structure of the aircraft.

Meteorologists now produce long-range forecasts and hourly observations, which enable the international airlines to operate their long range jet aircraft on 'flight plans' at up to thirty or forty thousand feet; the aircraft fly in clear sky conditions which ensures a steady flight for the passengers and an average speed of 600 miles an hour or more.

It was indeed a wonderful spirit that inspired the early pioneers to brave these perils. April, May and June 1919 saw no less than five entrants for the Atlantic flight: Mr. H. G. Hawker with a single-engined Sopwith; Mr. Raynham with a single-engined Martinsyde; Major (later Air Commodore) Brackley, C.B.E., D.S.O. with a Handley Page; Lieutenant Woods with a Short seaplane; and my brother with the Vickers Vimy.

Their attempts are an interesting contrast with the regular flights made today. Of these five contenders the first to make the attempt was the pilot Woods with a Lieutenant Wylie as his co-pilot; they had the support of the Short brothers and they decided to make their attempt from East-to-West. They flew from Kent heading for Ireland where they intended to re-fuel and push straight on for America. The engine of their aircraft failed just short of the Irish coast and they fetched up in the sea. The aircraft was badly damaged and the attempt was straightaway abandoned. This was in April 1919—and about as early in the year as was feasible.

The four remaining contenders all planned to fly the Atlantic West-to-East, starting from St. John's, Newfoundland. The next aircraft away was piloted by Hawker, with Commander K.

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Mackenzie Grieve as his navigator. They made a successful test flight on April 10th, but radio trouble and poor weather continually delayed their departure. From day to day the flight was postponed causing the British pilots to become increasingly impatient, particularly as May 6th saw the departure from Newfoundland of three American seaplanes which intended to fly the Atlantic via the Azores. This was a blow to the British pilots who felt that the honour of being first across the Atlantic would go to the United States. The American planes, which intended to make the crossing via the Azores to Lisbon and then on to Plymouth, were not, of course, eligible for the *Daily Mail* prize but they were obviously in the running to make the first trip across the Atlantic.

It is worth pointing out here that the American venture had the backing of the United States Government, whereas the four non-stop contenders all represented private enterprise. Hawker wrote afterwards of the American attempt:

They organised the whole thing on a magnificent scale, reduced the likelihood of failure to a minimum, sent out a big escort of ships, got four machines ready for the flight and generally did not scruple to spend a great deal of money. It cannot be too strongly insisted upon that this did not in the least detract from the honour of what the NC.4 achieved. It simply means this, that the Americans thought so much of the trans-Atlantic flight that they went in for it on a national basis, whilst the British authorities did not see eye to eye with them in this matter.

While weather reports still remained unfavourable to Hawker, the Americans were flying farther south on a route patrolled by warships and providing half-way rests for the seaplanes at the Azores. Probably this was in Hawker's mind on May the 18th when the weather had improved sufficiently for him to order chocks away, and he took the Sopwith forth on her ill-fated flight at 3.16 p.m.

The Sopwith, named *Atlantic* for the flight, was a single-engined biplane powered by a 350 h.p. Rolls-Royce engine. Fully loaded the machine weighed nearly 3 tons, which included 350 gallons of petrol, giving a flying range of 22 hours. The upper half of the

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fuselage was a streamlined boat to be used in the case of disaster. Both men wore special life-saving suits.

Trouble started soon after take-off, when the aeroplane ran into a thick fog over the Grand Banks. For four hours the airmen saw the sea only once, and they then ran into heavy rain squalls and an unexpected north wind which caused the aeroplane to drift south out of her course.

When the aircraft was some 500 to 600 miles out to sea, Hawker noticed that the water temperature in his radiator was getting uncomfortably high, due either to faulty shutters or a water leak, and little could be done other than hope that the water would cool off. Grieve was not able to take a star sight and worked out their position as being south of the track and well off the steamship route. The heavy cloud formation made it impossible to see ahead. The position was serious. Battling in a furious gale Hawker had managed to get the aircraft up to 10,000 feet, but he had to lose height to keep the water cool by shutting off the engine. It was during one of these glides that the engine refused to start again until very near the sea and both men thought the end had come.

In a break in the cloud Grieve saw the Polar Star and worked out the position which showed that they were 150 miles south of track, having been blown there while flying blind for four hours. When nine hours out from St. John's, Hawker observed that 180 gallons of petrol had been consumed fighting the north wind and they were not yet half-way over the Atlantic. The engine was still overheating and the water in the radiator was fast boiling away.

Hawker realised that their gallant attempt had failed. The two men decided to fly back to the steamship route and cross their track in the hope of sighting a steamer. They strained their eyes attempting to pierce the sleet and rain. When they could see the sea it was so violent as to give them no hope of salvation; in fact, with a forced-landing there the aircraft could only have lasted a few minutes.

Suddenly on the port side they saw a small ship. Grieve fired off Very lights as a distress signal and when Hawker was sure that they

had been seen, he shut off his failing engine and glided down to make a landing beside the ship. Due to the heavy seas the rescue took more than an hour. Without the fuselage boat, both men would have perished before aid from the small steamer could have reached them.

The steamer *Mary* which rescued Hawker and Grieve was only a small cargo vessel plying between Mexico and Perth. She had no wireless. The news of the thousand-to-one chance which effected the rescue of the airmen did not reach the outside world until a week later. In the meantime, the British public and the gallant band of aspirants for Atlantic fame in St. John's, Newfoundland, had given up Hawker and Grieve as lost. The following telegram was actually sent by King George V to Mrs. Hawker, condoling with her on the death of her husband.

The King fearing the worst must now be realised regarding the fate of your husband, wishes to express his deep sympathy and that of the Queen in your sudden and tragic sorrow. His Majesty feels that the nation has lost one of its most able and daring pilots, who sacrificed his life for the fame and honour of British flying.

On Sunday May 15th 1919 the S.S. *Mary* came into sight off the Butt of Lewis, Scotland, with her siren blowing and signalled that 'all hands have been saved from Sopwith aircraft'.

In the meantime one American seaplane, the NC.4 had safely made the journey from Trepassey Bay to the port of Horta in the Azores which she reached on May the 17th. Of the remaining American planes, only one other made it to the Azores and the NC.4 was the only aircraft still in a condition to press on with the journey to Lisbon. On May 20th, the NC.4 made the 190-mile air hop from Horta to Ponta Delgada and on May the 27th she set off on the long flight to Lisbon. The crossing took her rather more than nine hours, but she made it. Three days later she pushed on for England and reached Plymouth on May 31st.

The excitement over the arrival of the American flyingboat, and also over the gallant failure of Hawker and Mackenzie Grieve,

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somewhat detracted from the third attempt out of St. John's, Newfoundland, that of Raynham and Morgan with the Martinsyde aircraft *Raymor*.

Raynham was well aware that his Martinsyde aircraft was very much of the same speed as that piloted by Hawker. Two hours after Hawker had left Newfoundland Raynham and Morgan attempted to do the same. The runway was bad, the weather conditions were not good and the plane heavily overloaded. It crashed on take-off.

The Martinsyde was too badly damaged to allow any further effort to catch up with Hawker and Mackenzie Grieve. In fact, when the news of Hawker's failure broke, Raynham did attempt to start on hurried repairs, but he failed to complete them in time: Alcock and Brown got off before him. All the same, he made a final attempt on the Atlantic in the repaired Martinsyde in July, with a new navigator, but the plane once again crashed on take-off and Raynham finally called off the whole project.

Undeterred by the disaster which they suspected had overtaken their rivals, my brother and Brown went ahead with their arrangements for their historic flight.

The machine selected for the flight was the Vickers Vimy, Rolls-Royce-engined biplane. This machine had been built by Vickers Limited for long-range bombing with the idea of raiding Berlin; it was fitted with two 350 h.p. Eagle Mark VIII Rolls-Royce engines and it was estimated that the Vimy should have a range of 2,500 miles. With the sudden collapse of Germany in 1918, the Vimy did not have a chance to show her paces until June 1919. A standard type of Vimy was selected for the Atlantic attempt with the following alterations: she carried no armaments; the crew was reduced from three to two; the fuel tankage was increased to 855 gallons and the oil tankage up to 50 gallons; and finally she was equipped with a radio set.

The Vimy was test-flown by my brother at Brooklands, Weybridge, Surrey, and shipped to Newfoundland on May 4th. On

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arrival in St. John's, the aircraft was assembled and test-flown by Alcock on June 9th. The machine was found to behave splendidly, but the radio set was giving trouble. These radio sets seemed to have been the bogey of all the Atlantic aircraft. After the test flight the Vimy was landed at Monday's Pool where an aerodrome had been prepared under very adverse circumstances; they had to blow up rock, remove walls, attempt to level out all hills, remove fences and so on and all this to obtain a clear run of only 400 yards.

After the first test flight, all the mechanical defects were cleared up and a second test flight was made on June 12th. The aircraft and instruments were found to be in order.

There was no time to lose. The big Handley Page was still in the running; it was a huge four-engined biplane, with a wingspan of 166 feet, crewed by four men—Vice-Admiral Mark Kerr, Major Brackley, Major Trygve Gran and Engineer Wyatt. Altogether it was a formidable contender—and Alcock meant to get off first.

On Friday, June 13th, my brother had his tanks filled with petrol, oil and water. His intention was to make an early start on the morning of Saturday June 14th. This turned out to be impossible, owing to a very strong cross wind blowing across his take-off run. The engines were tested for the last time; all tanks were topped up ready for the start. Later in the day, the wind conditions improved and my brother decided that he and Brown should have their last meal under the wings of the aircraft so that they would be ready for an immediate start if conditions became possible.

Who were these two men selected for this most hazardous adventure in the history of man's conquest of time and space? My brother, with his cheerful, ruddy face, tousled hair and a ready wit delivered with a Lancashire accent, was typical of the extrovert pilot type. Brown was studious and scholastic; quiet and reserved, he would seem to have been more fitted to a bank or university rather than for this nightmare journey into the unknown. But the Vickers company had chosen its champions well; each was well

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endowed with the spirit which would be needed for this super-human trial before them.

My brother was born in Manchester in 1892 and it was in 1909 that he first showed an interest in aviation. I can well remember his early attempts to fly balloons, which he had constructed of silk and bamboo; these experiments caused a great deal of amusement to the family, but he continued and went on to small model aeroplanes. A year later he went to Brooklands, where he joined up with that well-known pioneer aviator, Maurice Ducrocq, a Frenchman.

He was also a well-known figure on the Brooklands race-track before the war. He used to race a Sunbeam car with an engine designed by Louis Coatalen and also three types of Douglas motorcycle, which were made near Bristol—but the motorcycles were only a sideline, although he had his successes.

There is no doubt that my own successful flying career was inspired by the achievements of my elder brother. I had a go with Douglas motorcycles in 1920, but my interest was only short-lived; my heart was entirely in flying. My son Antony also follows in the family tradition and is now commissioned into the Royal Air Force, flying Lightnings with No. 5 Squadron in Lincolnshire.

My brother obtained his Royal Aero Club flying certificate before he was 20 years old and took part in the first aerial races to be organised, flying a Maurice Farman biplane fitted with a 100 h.p. Sunbeam aero engine. He came third in the 1914 London-Manchester-London air race.

Something, perhaps, that not everyone knows, but which seemed very important to me as a small boy, was my brother's skill as a maker of toffee; his 'Parkin' and treacle toffee was the finest in the world. I can well remember my sister, my two younger brothers and myself sitting in a circle round him like a pack of wolves, whenever he came home on leave and could be persuaded to do his stuff.

On the outbreak of war he joined the Royal Naval Air Service and instructed cadets at Eastchurch. Then he went to the Turkish Front, where he was stationed at Mudros on the island of Lemnos. It was here that he designed the first triplane nightfighter and built

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her in his spare time; it was very successful. He was the first man to bomb Istanbul and gained the record for long-distance bombing raids, for which he was given the D.S.C. In the early part of 1918, when he was returning from a raid, he ran into engine trouble and was forced to land in the Sea of Marmara. He was taken prisoner by the Turks and during this period of forced inactivity he began his plan for an Atlantic flight. He was released in November 1918 and returned to England where he at once took up his ideas with the Vickers Aircraft Company.

Arthur Whitten Brown was born in Glasgow in 1886 and as a boy was interested in aerial navigation. His parents were American, but they settled in Manchester, where Brown was brought up. He worked for the Westinghouse company as a qualified engineer. When war broke out in 1914, Brown gave up his American citizenship and joined the army, but he soon transferred to the Royal Flying Corps. In 1915 he was wounded and taken prisoner. He was repatriated to England through Switzerland in December 1917 and was then employed by the Ministry of Munitions on aeroplane engine construction. After his demobilisation, he returned to Manchester. Handicapped by a lame leg, he was unable to find civilian employment but he managed to get a letter of introduction to the Vickers' Works Manager, Maxwell Muller. At the subsequent interview, Brown's interest in navigation was revealed. By this time, Alcock had persuaded Vickers to enter a Vimy for the trans-Atlantic contest, which he would pilot. All he needed was a navigator. And so, through Maxwell Muller, the two men met, and the partnership which was to earn them both lasting fame was formed, almost by accident.

Alcock paid high praise to Brown's skill as a navigator after the flight. When they made their landfall in Ireland, they were only ten miles off the course which they had planned in Newfoundland. Brown relied upon his own system of navigation, based upon the theory of marine navigation, altered and adapted to air problems. He used both dead reckoning and double drift methods.

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Hawker also told newspaper reporters after the safe arrival in Ireland that the navigation 'must have been extraordinarily good'.

I only met Brown on two or three occasions; he was a man of great charm, but so shy and withdrawn that it was difficult to get through to him at all, and I cannot claim to have known him, though I liked and respected him.

Weather conditions were reported as fog and drizzling rain, but my brother was weary of postponements and decided to take off. Just before the start an incident occurred which nearly delayed the flight for another day. One of the picket ropes holding the machine to the ground became loose and was whipped up by the wind; it was flung across a copper pipe, denting it badly, and they had to wait while the pipe was renewed.

As my brother and Brown took their seats in the Vimy, quite a number of Jonahs in the crowd watching the take-off were shouting that the airmen would kill themselves before they took off. They had some reason for their fears. The machine had to take off uphill in the face of a 40 m.p.h wind on an aerodrome only 400 yards long. With a normal load, the take-off would have been perfectly safe, but the Vimy was carrying an extra load of petrol which gave them an all-up weight of 5 tons; on top of this the aerodrome was by no means good and the surface for the take-off run was extremely bumpy.

At 5.13 p.m. (British Summer Time) my brother, with a cheery good-bye and a wave of the hand, gave the order chocks away from the wheels; the engines answered to the throttles with a roar, and the heavily loaded Vimy started to move forward slowly, gaining speed as she rocked and lurched over the uneven ground. *The Times* correspondent described the actual take-off:

Gradually increasing the pace, the Vimy slowly at first moved up the rather steep gradient of the aerodrome—100 yards—200 yards—300 yards—and the machine still moved forwards, but showed not the least desire to leave the ground. Pessimists who had foretold that, with its exceptional load, it could not leave an uphill ground in the face of a 40 mile an hour gale began

Introduction

to croak disaster, when suddenly and at just the right moment Captain Alcock operated his controls. The machine jumped off the ground, *zoomed* over a fence which was a few yards ahead, bounded over the eastern end of the aerodrome, and began steadily to climb. For a moment there was silence, for all but a few had failed to realise that the machine was off on its journey—the contour of the land gives a very poor idea of height—and then so loud a cheer was raised that it must have carried to the airmen even against the gale. . . .

Again there were cries of ‘He’s coming down’, for the country gave the impression that the machine was scraping the treetops of a small wood directly in its path, when in reality it was many feet above, and climbing steadily.

The Times correspondent also added a note of speculation:

It may be that Captain Alcock was determined in his final decision by the very circumstantial report from Harbour Grace that Admiral Kerr had announced his intention of starting the Handley Page this afternoon.

Whatever the deciding factor, the decision to go was only made at the eleventh hour, and the Vimy is now speeding at about 100 miles an hour across the Atlantic towards England.

PART I

My Transatlantic Flight

by Sir John Alcock

My Transatlantic Flight

ALTHOUGH the actual time occupied in my Transatlantic flight was under 16 hours, it may be fairly said that it took ten years to accomplish. It was perhaps owing to the knowledge of this fact that the public appreciation of the feat overwhelmed me in no small degree. To them it was a sudden and perhaps sensational achievement; but it was really but the successful outcome of much preparation. There is always satisfaction in being the first to do anything, whatever it may be, and while the lapse of time may intensify that feeling, the flight was nothing more than the execution of a long conceived plan. It was not the happy issue of a hastily planned venture, nor was it the seizing of favourable factors. At the risk of appearing egotistical I would lay stress on this fact, for before leaving Newfoundland we felt confident of our arrival on the other side; but the confidence was derived very largely from experience and the knowledge of a machine capable of the journey. As in everything else, there is no royal road to long-distance flying. Physical fitness and technical knowledge are essential, for the strain is certainly heavy both on man and machine.

Ten years of continuous flying undoubtedly stood me in good stead, and had I been less fit or less experienced, the excellent machine produced by Messrs. Vickers and the Rolls-Royce engine must have been sacrificed.

It was in 1910-11 that I first took up flying, starting at Brooklands on a Maurice Farman machine with an 8-cylinder water-cooled Sunbeam engine. This machine was remarkable in many ways, and before its time in conception. For fifteen months it was used with excellent results, and as a matter of fact it was commandeered on the outbreak of war, when I took it to Eastchurch for instructional work. Men and machines were badly needed then,

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and with others equally keen I set to work in order to produce the necessary pilots for the Air Service. It was hard work, and difficult at times owing to the serious shortage of machines, but gradually order was derived from chaos, and we turned out some of the cleverest pilots on any front. Many, alas, are no more; but they rendered yeoman service at a critical time. Poor Warneford¹ was one of my pupils, as was Colonel Mulock.

It was useful work, and very necessary also, but we chafed at its limitations. The desire to be out and in it was always with us. To get a taste of the real thing obsessed every one, so I was frankly pleased on receiving orders to proceed to Roumania for active service. That front, however, I never reached, for war operations closed the sphere to British arms, and Mudros was the base to which I was attached. There one got all that one could wish of fighting. Ostensibly a scout, I won the record for long-distance bombing operations. Our sphere was a wide one at times, and we made flights extending over eight hours. Constantinople, Adrianople, Panderma and the Dardanelles were bombed, and seven enemy machines brought down were officially put to my credit, and brought me my much-prized D.S.C.

But there was more than actual flying to be done. Machines were scarce, and we were proud of the fact that a fighting scout was actually built by us at Mudros. And a very good machine it proved, and might have rendered a good account of itself, had it not been accidentally destroyed by a following machine landing on top of it in the darkness. Of necessity we took chances in those days—or rather nights. It is easy to land a machine in the daytime, and with plenty of ground a squadron may be assembled; but to take a squadron over water and land them safely in the dark is hazardous, to say the least. It was in these circumstances that our Mudros machine was crashed and ruined. We had no time to grieve, however; accidents were part of the day's work, and we paid but little heed to our loss. There were now plenty of

¹ Flt. Sub-Lt. R. A. G. Warneford won the Victoria Cross for shooting down the first Zeppelin but was himself killed soon after.

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machines, and we were over the enemy all day and every day.

But my bad day arrived. In the morning I had accounted for two German machines. They were acting as convoy to a camera carrier. One I put straight to the ground. The other proved more difficult, but I stuck to him till I had him beat, and later his drifting propeller was picked up by our men with the pilot's last message written large on one of its blades. I have just received the following letter from the Bulgarian lady for whom—as it now transpires—this message was intended. Although rescued on this occasion, he seems to have met his fate later:—

Dear Sir,

I apologise for having taken the liberty to write to you without being known by you—the liberty to write you and to have your attention just for a moment follow these lines.

Therefore I must introduce myself to you. I am the young lady to whom the German pilot Muller, that you brought down two years ago, had written his last greetings on the propeller of the wrecked seaplane. Some time ago I received the number of the *Daily Mirror* which contains a picture of the propeller and your photo. I was very curious to know something about you, and Captain Wildish and Commander Greig, who know you very well, told me what a good flyer you are, and that just recently you gained the prize in a concourse for a flight over the ocean. I congratulate you for that.

My friend Muller is a very good pilot, he was one of the best, and I see that he has had a worthy ending, more than that, you must have excelled him to have beaten him down.

I myself have never been in an aeroplane, and don't know what the sensations may be when one is so high up, but there must be something that makes you risk your life so readily, you really must feel great having conquered the space.

I began by introducing myself, and I must say something more to let you have a complete picture. I am a Bulgarian and am a graduate of an American college; I lived several years among English and American people, and learned to love your language and literature. Last winter we had great many English people here, and I had the chance to practice the language, and enjoyed it greatly.

I shall be immensely pleased if you send me a good photograph of yourself, and if you add some snapshots of your seaplane too, I shall enjoy them none the less, and with the picture in the *Daily Mirror* I shall highly treasure.

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I shall not say how I would wish to possess the famous propeller, but rightly it belongs to you; it is your trophy, for it is you have risked your life.

Believing you will answer my small request,

I am, with very best wishes,

Yours sincerely,

(sd.) STRAOKA ILIEVNA.

Varna, Bulgaria,

21 Vornishka.

1/8/19.

That night, however, I went out of business. While flying comfortably over the enemy lines, the reduction gear sheared off. We tried to keep going on one engine, and managed to cover 60 miles in that condition, but eventually were forced to descend in the sea off Suvla Bay. Quickly the Turks located us, and sniping began. We hung on to the wreck as best we might (there were three of us), but as Johnnie Turk began to get the range, we struck out for the land, swimming cautiously in the darkness towards the rocks, amongst which we eventually hid from our pursuers. All night we lay concealed, and until noon on the following day. How long we could have eluded the enemy I would not like to say, but we were utterly worn out, and one of us was showing such unmistakable signs of nervous exhaustion that we agreed to hand ourselves over, deeming discretion the better part of valour.

Three burly Turks pounced upon us with little ceremony, stripping us of everything as a preliminary precaution. They took everything, and in somewhat embarrassing circumstances we were ruthlessly prodded towards the Turkish camp. Fatigued and distressed in mind and body, we were much relieved to receive a courteous reception from the Turkish commander, who promptly punished our brutal captors, and returned to us all our belongings. Save a few pounds, all was handed back—clothes and the contents of our pockets down to the smallest item. We were well fed and kindly treated, and quickly recovered from the trying circumstances of our adventure.

We were sent to Constantinople, where Djavid Bey, the Finance Minister, received us. He promised us hospitable treatment, so,



Front view of the Vimy at Weybridge. The small propeller which ran the wireless generator can just be seen on the bottom right-hand wing, to the left of the engine.

Back view of the Vimy.





A. W. Brown

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well content, we went for temporary detention to a local jail. In this, however, we were grievously disappointed. The food was scarce and bad—indeed, we looked like being starved—but what upset us more than anything else was the filthy condition of our temporary home. Vermin swarmed in every hole and cranny; I never wish to live under similar conditions again. What made matters worse was that we were to be moved on the morrow. But it was always ‘tomorrow’. True to tradition, our Turkish jailer’s tomorrow was always on the horizon. We remained a month, and how much longer that entomological museum might have been our home I cannot say, had we not been able to get a message to Djavid Bey, who promptly ordered our removal to a detention camp, where we were housed with some hundred prisoners of war, mostly from Scottish regiments. There we had a good time, with freedom and abundant food. It was indeed a happy place, that camp at Kedos.

One of our chief amusements was a theatre, built and run by ourselves. There was no end of talent among the men, and many a London manager might have been proud of the shows provided. The Turkish officials always came to these entertainments, one of which we shall remember as long as we live. It was the evening of September 27th, and the bill was ‘Theodore’, a new piece prepared by our repertory company. The theatre was crowded, and the Turks were in their accustomed place, when about half-way through the piece a cry of ‘Fire!’ was raised. It was not the theatre, but the town itself that was alight, and the subsequent conflagration beggared description. As I say, none of us will ever forget the sight. The entire town was burned to the ground, and blazed throughout the night without let or hindrance. Where a western people would have hurried to stem the flames, these Turks fled from the scene, wringing their hands in abject terror. As a result, the town was destroyed, and there was no more camp and no more theatre for us. We lived in the open for a month.

Again it was a question of ‘tomorrow’. We were to be moved up country to another and larger camp, but nothing was done, and when at last instructions arrived, Bulgaria had thrown up the

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sponge, and Master Turk saw the red lamp of defeat so clearly that we were ignored. When the inevitable end did come, we left Turkey on November 18th, after thirteen months' captivity, which was on the whole a very good time.

It was slow work trekking back. We went to Smyrna, Alexandria and Cairo, and thence to England, where we arrived on December 16th in good time for a Christmas which some of us had never expected to see again in our native land.

As soon as it was possible for me to do so, I saw General Scarlett and was demobilised on March 10th. At last I was free to attack the big problem of crossing the Atlantic. I approached Messrs. Vickers and the sporting enterprise appealed to them. A standard Vimy bomber was used with the sole exception of the fitting of extra tanks for petrol and the bomb racks being dispensed with. I remained at the works at Weybridge to supervise the assembling of the machine, with the above slight alterations.

On Good Friday we tried it thoroughly, and found it so satisfactory that it was packed for transhipment without delay. Strikes were the order of the day, however, and we were hung up for a considerable time at the London Docks. But at last we got off, sailing on May 13th for St. John's, Newfoundland, where we landed and unpacked on the 26th.

It was arranged that the machine should be assembled in a cricket field at Quidi Vidi, so there we took it on the 26th of May. Screens and scaffolding were erected and everything went well till Friday, the 30th of May, when the weather broke. Rain poured down on us and eventually work on the machine had to be abandoned altogether. Till the following Monday evening it rained or snowed incessantly—four days of fierce gales.

But there is an end to most things, even to a Newfoundland storm. The rain clouds lifted and atmospheric conditions returned to the normal. We seized our chance for a trial flight on Monday, the 9th of June. The machine proved satisfactory, and while the wireless installation called for some attention, we felt satisfied with the result and landed at a place called Monday's Pool, where, with

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the aid of thirty men, I had blasted rocks and levelled land, walls and fences in order to get a clear run of 400 feet.

Any small defects developed during the first trial having been rectified, a second trial was carried out on Thursday, the 12th of June. This, our final test, was highly satisfactory in every way; the Rolls-Royce engine ran smoothly and the machine behaved admirably. So pleased were we with the result that we decided to set off as quickly as possible, and on the following day, Friday, the tanks were filled with petrol, lubricating oil and water. The machine was a standard machine as designed by the Vickers designer, R. K. Pierson, B.Sc., M.I.C.E., one who has, I fear, received insufficient acknowledgment for the excellence of his work. The machine, as I say, was a standard type, but the bombs and bombing gear were of course replaced by petrol storage tanks. One of these I fashioned as a life-saving raft of boat shape, and sufficiently buoyant to keep both of us afloat should any mishap occur. To ensure this tank being available, the petrol supply was arranged to draw from it first, when by a special system of connection it could be easily detached and floated. Another provision for an unexpected landing was a store cupboard fitted in the tail, where the emergency rations were placed. These would be clear of the waves when the machine floated. We hoped to make the journey safely, but it was only prudent to take such precautions, for accidents will happen at times however careful one may be.

All looked well, however, and we hoped to leave early on the Saturday morning (June 14th). But unfortunately a strong cross wind was blowing when we awoke, and although we ran the engine and found it quite in order, a start was impossible in the circumstances. We hoped for some slackening of the wind later in the day, and we were not disappointed. The conditions seemed propitious, so Brown and I decided to 'chance our arms'. Under the wings of the aeroplane we had our last meal, a fairly hearty one, as one never knows. On board we had stored provisions for the journey, sandwiches, plenty of Fry's chocolate, Horlick's Malted Milk, and hot Oxo in a Ferrostat Vacuum Flask, a wonder-

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ful contrivance out of which we had hot drinks long after our arrival in Ireland.

It was at 4.13 p.m. Greenwich time (5.15 p.m. British summer time) that we made the long-hoped-for start. Some of the cross wind remained and the take-off was up a slight gradient, and there was insufficient room to start head to wind. We managed well, however, but a high range of hills on either side made climbing difficult and occasioned bumps which kept us down.

Emerging from the valley, however, we got head to wind, and having climbed quickly to 1,000 feet, we set out on the eventful journey. Rising steadily, we passed over St. John's and Cabot Hill, and at 4.28 p.m. (Greenwich time) crossed the shore bound S.E. 124° (magnetic); destination Ireland. Hardly had we crossed the coastline than our wireless installation was rendered useless through a seized armature. This was indeed a cheerful beginning, and it accounted for our silence throughout the flight. Visibility was good at the outset, but I saw ahead the dreaded fog of Newfoundland, and within a short space we were racing between it and the clouds. For seven long hours we travelled thus, sighting neither sea nor sky. Gradually the light failed and the fog increased until presently we found ourselves buried in heavy fog. The conditions were bad, but I held on to the course set by Brown till suddenly we shot into a clear patch in the clouds. Quickly Brown fixed our position from the Pole Star, Vega and the Moon, and for about half an hour we had a clear sky overhead. Then, however, thick fog enveloped us again, and a second mishap nearly brought our venture to an untimely end. The air-speed indicator failed to register, and bad bumps prevented me from holding to our course. From side to side rocked the machine, and it was hard to know in what position we really were. A spin was the inevitable result. From an altitude of 4,000 feet we twirled rapidly downward. It was a tense moment for us, and when at last we emerged from the fog we were close down over the water at an extremely dangerous angle. The white-capped waves were rolling along too close to be comfortable, but a quick glimpse of the horizon enabled me to regain control of the

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machine. Getting back on to our course, I climbed to 7,000 feet above sea-level. Occasionally we saw the moon, but Brown could get no reading. I hoped to get above the fog and clouds, but it seemed impossible. Climb as we might, the clouds seemed to climb still faster. For five or six hours we continued the attempt, but in vain, hail and sleet lashing across us. At 11,000 feet we met with some reward, and the sun at last appeared trying to force its way through the clouds. We then descended, but were close over the sea before clear visibility was obtained, and we found a strong sou'wester blowing.

We decided to stay at this low altitude and skimmed swiftly over the surface of the water for some forty minutes. Suddenly, and without a moment's warning, so fast were we travelling, the sea disappeared from beneath and the shimmering green of land gladdened our hearts. But it was only for a moment. Again we were over the western ocean, and we learned later that we had crossed the outlying islands of Eeshal and Turbot. In the rain we could see no mainland, but we knew it must be near at hand, and we were not surprised but delighted to find ourselves over it. Pleased with our position, we flew on for several minutes till suddenly the tall masts of a wireless station stood before us (it was Clifden we found afterwards). Firing Verey signals we circled round the station and over Clifden town, but without response. By the wireless station I had noticed what I took to be a suitable field, so we decided to land there. But what I thought was a field turned out to be a bog. Still, we received no hurt, although the machine was somewhat shaken by the sudden stoppage. Men ran quickly from the Marconi station to our assistance, which fortunately was not required. They had no idea who we were, and on hearing that we had crossed the Atlantic their astonishment was exceeded only by their enthusiasm. At the station we received every kindness, and the news of our arrival was soon going out in every direction.

We arrived at Clifden at 8.25 a.m., so the time occupied in the journey was 15 hours 57 minutes. As the distance covered was

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1,960 miles, the average speed was over two miles a minute, which, it must be admitted, was very good going in the circumstances.

We were too tired to think much of the feat at the time, and our subsequent experiences having been of an even more strenuous if gratifying nature, it is only now, when in possession of some leisure, that any retrospect is possible. First one must give due praise to the machine, which reflects great credit on the makers, Messrs. Vickers, and their designer, R. K. Pierson, B.Sc., M.I.C.E. It behaved splendidly throughout, and neither figuratively nor literally let us down once. And the Rolls-Royce engine, a wonderful piece of work, ran without a hitch throughout. In the varying climatic conditions of the voyage the Claudel-Hobson carburetter deserves praise also, as does the All-British Watford Magneto, which worked admirably in the damp atmosphere encountered. There remains the fuel, the Shell spirit, and of it I cannot speak too highly. Like all else it went to make the happy combination which ensured success.

For ourselves, we experienced no discomfort, and with the exception of the failure of the wireless and that of the air-speed indicator, with its resulting spin, we had no anxiety whatever. We wore but ordinary clothing with Gieve's life-saving waistcoats underneath the Burberry flying suits which served us well. Having a love of freedom at the neck I left mine open there, and so shipped sleet and rain in fairly generous quantities. But for the most part we were comfortable all the way. Brown wore goggles in making observations, but I left mine on my forehead and never missed them, so sheltered is the cockpit on the Vickers-Vimy-Rolls machine. We sat side by side all the way, but never a word could we exchange. By signs we conversed when necessary, and I suffer still as a result of long proximity to a deafening exhaust. Travelling as we were over two miles a minute with the exhaust rattling like a machine gun battery, this is hardly to be wondered at, but with that exception I felt no bad effects from the experience. Nor did the machine suffer either. It is to be placed, I understand, in the Museum at Kensington, and there all who so desire may see it at their leisure.

PART II

Flying the Atlantic in Sixteen Hours

by Sir Arthur Whitten Brown
Introduction by Lord Northcliffe

Introduction

When, on that winter's day sixteen years ago, Orville and the late Wilbur Wright, having fitted a motor of their own construction to a glider with which they had been experimenting, proved that this machine would rise from the ground with its pilot in a controlled flight, it became clear that it was merely a question of time, and of mechanical improvement, for heavier-than-air craft to carry a commercial load.

Being myself a spectator of early attempts at flight, I realised that what was wanted was tangible encouragement; also that attention should be focused upon a science of such profound importance.

The prizes given by my journals were devised, therefore, to these two ends—to encourage the flying man and to interest the public.

Both aims were, I am assured, achieved. Aerial progress in the design, construction, and handling of craft, followed upon the winning of these prizes; and I have the word of the flying men themselves that the encouragement came, so far as they were concerned, just when it was most required.

The first direct trans-Atlantic flight of the late Sir John Alcock and Sir Arthur Whitten Brown, with which we are concerned here, was an example unparalleled of courage and endurance, of navigational skill in a new element, and of the reliability attained already with mechanism which is still admittedly crude. It had, furthermore, this advantage. It crystallised in an exploit attracting the attention of the world the progress which had been made, aerodynamically, under the stimulus of war.

Introduction

Sir Arthur Whitten Brown's narrative of this flight, which will become an aerial classic, I commend heartily to the reader. Into those sixteen hours was crowded more adventure than falls to the lot of most of us in a lifetime.

It is now for us to reap, in the development of commercial air transport, the fruit not only of flights like these, but of the heroism and sacrifice of our pilots in war.

In this respect, though I cannot pretend to follow technical progress as closely as I could wish, I am told that the men and machines are, at the moment, ahead of the organisation on the earth which should facilitate flying in mists and fogs, and also at night. Our aim, therefore, must be to consolidate and extend commercially, by the equipment and maintenance of international airways, that knowledge and data which are now available.

NORTHCLIFFE

May 17, 1920

CHAPTER ONE

Flying the Atlantic in Sixteen Hours

IT is an awful thing to be told that one has made history or done something historic. Such an accusation implies the duty of living up to other people's expectations; and merely an ordinary person who has been lucky, like myself, cannot fulfil such expectations.

Sir John Alcock and I were told so often, by the printed and spoken word, that our transatlantic flight was an important event in the history of aviation that almost—but not quite—I came to believe it. And this half-belief made me very humble, when I considered the splendid company of pioneers who, without due recognition, gave life, money, or precious years, often all three, to further the future of aeronautics—Lilienthal, Pilcher, Langley, Eiffel, Lanchester, Maxim, the Wrights, Bleriot, Cody, Roe, Rolls, and the many daring men who piloted the weird, experimental craft that were among the first to fly.

I believe that ever since man, but recently conscious of his own existence, saw the birds, he has desired to emulate them. Among the myths and fables of every race are tales of human flight. The paradise of most religions is reached through the air, and through the air many gods and prophets have passed from earth to their respective heavens; and all authentic angels are endowed with wings.

The present generation is lucky in that, despite this instinctive longing since the beginning of human history for the means of flight, it is the first to see flying dreams and theories translated into fact. The coming generation may see the realisation of even wilder dreams. The development of practical aviation within the past fifteen years has been startling. The aeronautical wonders of the next fifteen years are likely to be yet more startling.

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Five years ago, before war and military necessity provided a supreme *raison d'être*, flying was but a costly and dangerous pastime. As such, it attracted the first class adventurers of every race, many of whom lost their lives on Jabberwock-like aircraft, built and tested before experimental data and more accurate methods of calculation became available.

But even these men could not realise the wonderful possibilities of the coming air age, of which they were the pioneers. Nearly all the early aeroplanes were born of private enterprise, for capitalists had no faith in the commercial future of flight. Very few firms concerned themselves solely with the manufacture of aircraft or aero engines, and only two or three of the great engineering companies had the vision to concern themselves with aeronautics.

Among the few important companies that, in those days, regarded aeronautics seriously was Vickers, Ltd. They established an experimental department, and, as a result of its work, began to produce types of military aircraft which were in advance of their period. Later, when the whirlwind of war provided the impetus that swept pioneer aviation into headlong progress, the Vickers productions moved with the times, and helped largely to make the British aircraft industry the greatest in the world. Now that aviation has entered the third phase of its advance—that of a peacetime commercial proposition—they are again in the forefront of production. Incidentally, they provided me with the greatest chance of my life—that of taking part in the first non-stop flight across the Atlantic.

At this point, I desire to pay a very well-deserved tribute to the man who from the beginning has backed with money his faith in the future of aviation. The pioneer work of aeronautics has been helped enormously by the generous prizes of Lord Northcliffe and the *Daily Mail* for the first flights across the Channel, from London to Manchester, around the circuit of Britain, and, finally, across the Atlantic.

In each case, the competition seemed impossible of fulfilment at the time when it was inaugurated; and in each case the unimaginable

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tive began with scoffing doubts and ended with wondering praise. Naturally, the prizes were offered before they could be won, for they were intended to stimulate effort and development. This object was achieved.

But for the stimulus of these competitions, Great Britain, at the beginning of the war, might well have been in an even worse position as regards aviation than she was. And all who flew on active service during the first three years of the war realise what they owe to Lord Northcliffe's crusades for more and better machines, and for a more extensive use of aircraft.

Having helped to win one of the *Daily Mail* prizes, I am not going to quarrel with the principle of flying competitions. Certainly, the promise of reward brings to the surface ideas and potential powers which might otherwise lie fallow; but I do not believe the system of money prizes to be altogether an economically sound proposition. It is not generally realised that, as a rule, the amount spent by each of the firms that enters a machine for such a contest as the transatlantic flight vastly exceeds the amount of the prize; although the money award more than covers the expenses of the aviators who gain it.

Would it not be more practical to pay directly for research work? Anybody with vision can see some of the infinite possibilities which the future of aviation may hide, and which can be found only by painstaking, properly-applied research. There are plenty of men able and anxious to devote themselves competently to seeking for yet hidden solutions whereby flying will be made cheaper, safer, and more reliable. What is especially wanted for the moment is the financial endowment of research into the several problems that must be solved before the air age makes the world a better place to live in, and, by eliminating long and uncomfortable journeys, brings the nations into closer bonds of understanding and commerce.

Apart from the honour of taking part in the first non-stop flight between America and Great Britain, I am especially pleased to have helped in a small way in the construction of a new link

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between the two continents to which I belong. My family is deeply rooted in the United States; but, generations ago, my ancestors were English, and I myself happened in Glasgow. This was in 1886, when my parents were visiting that city.

I was an only child, and I was so well looked after that I caught neither a Scotch nor an American, nor even a Lancashire accent: for later, between visits to the United States, we lived in Manchester. There, after leaving school, I served an apprenticeship in the works of the Westinghouse Electric and Manufacturing Company.

I inherited, in some degree, a love of and an instinct for engineering from my father, one of the best mechanical engineers I have ever met. He helped to develop this instinct by encouraging me in everything I undertook, and by making me profit by the results of his experience.

In the works I was for a time a workman among workmen—a condition of life which is the best possible beginning for an embryo engineer. I found my associates of the workshop good companions, useful instructors, and incorrigible jokers. My father's warnings, however, saved me from hours of waiting in the forge, at their direction, while a 'straight hook' or a 'putting-on tool' was made, and from hunting the shops for the 'spare short-circuit'.

I was congratulating myself on making good headway, and, in articles accepted by various technical journals, was even telling my elders all about engineering, when the outbreak of war changed my plans and hopes, and interfered with the career I had mapped out for myself. In fact, I was in exactly the same position as many thousands of other young men at the beginning of their professions.

Although of American parentage and possessing American citizenship, I had not the patience to wait for the entry into the war of the United States. With an English friend, I enlisted in the University and Public Schools battalion when it was formed in September, 1914. And, although at the time I had no more notion

of it than of becoming President of the League of Nations, that was my first step towards the transatlantic flight.

Those were wonderful days for all concerned in the early training of the battalion at Epsom. In knowledge of drill our officers started level with us. Several times I saw a private step from the ranks, produce from his pocket the Infantry Training Manual, and show a subaltern where he had gone wrong. Doubtful discipline, perhaps—but excellent practice, for most of the original privates of the U.P.S. soon became officers of the New Army. I was gazetted a second lieutenant of the Manchester Regiment in January, 1915, and with it saw service in the trenches before Ypres and on the Somme. Then came the second step towards the transatlantic flight. I had always longed to be in the air, and I obtained a transfer to the Royal Flying Corps as an observer.

I had the good fortune to be posted to No. 2 Squadron, under Major (now General) Becke. While in this unit I first experienced the mixed sensations of being shot down. One day my pilot and I were carrying out artillery observation over Vendin le Vielle when, at a height of 8,000 feet, two anti-aircraft shells set our machine on fire. Somehow, the pilot managed to bring down his craft in the British lines; but in landing it tripped over some telephone wires and turned a somersault, still blazing at various points. We were thrown out, but escaped with a few burns and bruises.

After a short rest in England, I returned to the squadron. I soon left it for good, however. One dull, snowy day, a bullet perforated the petrol tank of the machine in which, with Lieut. Medlicott, I was reconnoitring behind the enemy lines. As a result, we were unable to reach the British zone. We landed in occupied territory, and I knew the deadly heart-sickness that comes to all prisoners of war during the first few days of their captivity.

I was repatriated after being a prisoner of war in Germany for fourteen months, followed by nine months in Switzerland. Medlicott, meanwhile, made thirteen determined but unsuccessful bids for escape before being murdered by the Germans in 1918, while indulging in a fourteenth attempt.

Our Transatlantic Flight

My two years of captivity involved, strange to say, the third step towards the transatlantic flight; for it was as a prisoner of war that I first found time to begin a careful study of the possibilities of aerial navigation. This I continued after returning to London, where, at the Ministry of Munitions, I was employed in the production of the larger aero-engines.

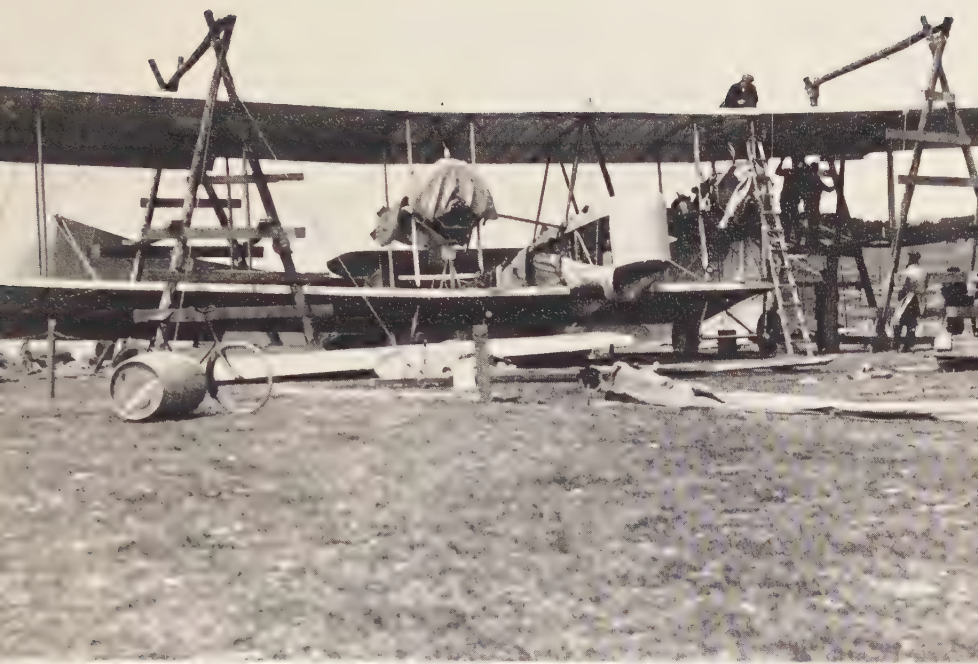
When, soon after the Armistice, the ban on attempts to fly the Atlantic was lifted, I hoped that my studies of aerial navigation might be useful to one of the firms that were preparing for such a flight. Each one I approached, however, refused my proposals, and for the moment I gave up the idea.

It was entirely by chance that I became involved in the transatlantic competition. One day I visited the works at Weybridge of Messrs. Vickers. While I was talking with the superintendent, Captain Alcock walked into the office. We were introduced, and, in the course of conversation, the competition was mentioned. I then learned for the first time that Messrs. Vickers were considering an entry, although not courting publicity until they should have attempted it.

I sat up and began to take notice, and ventured to put forward my views on the navigation of aircraft for long flights over the sea. These were received favourably, and the outcome of the fortunate meeting was that Messrs. Vickers retained me to act as aerial navigator.

I soon learned to have every confidence in the man who was to be my pilot. He flew for years before the war, and he had a magnificent record for long-distance flying when engaged in bombing Constantinople and other parts of Turkey, with the detachments of the Royal Naval Air Service in the Eastern Mediterranean. Jack Alcock's very regrettable death has deprived aviation of one of its finest pilots, and his many friends of a man for whom they had the greatest respect.

Alcock and I set to work, and, with every assistance from the Air Ministry and the Admiralty, we soon had our apparatus and instruments ready for shipment to Newfoundland. Besides our



After shipment to Newfoundland, the Vimy is being reassembled at Quidi Vidi. Bottom picture shows the partially assembled Vimy being moved up the airstrip and the top picture shows her near completion with only the right wing missing.





Alcock and Brown beside the reassembled Vimy in Newfoundland.

Flying the Atlantic in Sixteen Hours

two selves the Vickers transatlantic party consisted of ten men from the works and a specialist on Rolls-Royce aero-engines.

We sailed from Southampton on the *Mauretania*, on board of which its commander—Captain Rostron—made me free of his bridge, and, as a widely experienced navigator, gave me much good advice. The Vickers-Vimy machine, with all stores, left later, by a freight boat.

From Halifax, Nova Scotia, we proceeded to Port aux Basques, and thence by way of the Reid Newfoundland Railway to St. John's. There we joined the merry and hopeful company of British aviators, who, long before we arrived, had been preparing for an attempt to win Lord Northcliffe's prize.

That four of them did not forestall us was due in part to very bad luck, and in part to their whole-hearted patriotism. They wanted for their country the honour of the first transatlantic flight, whether non-stop or otherwise: and, being unable to continue the wearisome wait for good weather in face of the news that the American flying boat, N.C.4, had reached the Azores, they made their attempt under conditions that were definitely unfavourable. Fate tripped up Raynham and Morgan at the start, when they tried to take their heavily-laden machine into the air while running over a too-short space of uneven ground, with the wind cross-ways to it. Fate left Hawker and Grieve a rather better opportunity, but brought about their fall when they were half-way to success, owing to a mishap which, though trifling, had the same effect as a vital breakage.

It is superfluous, at this time of day, to offer sympathy to such gallant competitors: but I seize the opportunity of expressing admiration for their splendid effort, and for the spirit that prompted it. To Hawker and Grieve we owed particular thanks, in that we profited to a certain extent by what we learned from the cabled reports of their experiences. For Grieve, as an expert on aerial navigation, I have the deepest respect, and I am in full accord with his views and theories on this my own subject.

The same sort of odds-against accident that sent them into the

Our Transatlantic Flight

sea might well have befallen Alcock and me. But it did not; and our freedom from it was an important factor in our good fortune. Others were the excellence of the Vickers-Vimy machine and the Rolls-Royce engine. Whatever credit is ours should be shared with them, and with Mr. R. K. Pierson, B.Sc., M.I.C.E., the designer of the Vickers-Vimy.

I realise that our flight was but a solitary finger-post to the air traffic—safe, comfortable, and voluminous—that in coming years will pass above the Atlantic Ocean. But even had the winning of the competition brought us no other benefits, each of us would have remained well content to be pioneers of this aerial entente which is destined to play such an important part in the political and commercial co-operation of Great Britain and America.

CHAPTER TWO

St. John's

'HAWKER left this afternoon.'

This message was shouted by a chance-met motorist, who held up our car as we were driving back to St. John's from Ferryland on the evening of May 18, after an unsuccessful search for an aerodrome site.

'And Raynham?'

'Machine smashed before he could get it off the ground.'

We thanked the stranger for his news, and passed on to hear further details at the Cochrane Hotel, the headquarters of the several Transatlantic flight contingents at St. John's. We had rather expected the Sopwith and Martinsyde parties to make an attempt on the 18th, although the conditions were definitely unfavourable. The news of the American N.C.4's arrival at the Azores had spurred them to the great adventure, despite the weather.

The United States flying boats were not competing for the *Daily Mail* prize; but Hawker and Grieve wanted to gain for Great Britain the honour of being the first to cross the Atlantic by air. The result was the very gallant effort that ended in the sea, half-way to Ireland.

While exceedingly sorry for Raynham, we were glad that Hawker had started, after his weeks of weary waiting, and we wished him all success; for, with one exception, there was the best possible feeling among the small colony of British aviators who had congregated at St. John's for the competition. In any case, if Hawker succeeded, and we no longer had a chance of winning the prize, we meant to demonstrate the high qualities of the Vickers-Vimy machine by flying from Newfoundland to Ireland.

Our Transatlantic Flight

We had arrived at St. John's early on the morning of May 13, being only twelve hours late on a scheduled time of twenty-seven hours for the journey from Port aux Basques. Thirteen, by the way, we regarded as our lucky number. The construction of our transatlantic machine was begun on February 13, it was number 13 of its class, and it reached Newfoundland on May 26 (twice thirteen). Our party, with the mechanics, totalled 13, and we arrived at St. John's on May 13. Later, we were disappointed at having to postpone the get-away until June 14, instead of leaving on June 13.

We hired a car, and, driving to Mount Pearl, began what was to be a long and difficult hunt for any kind of a field that could be improvised into an aerodrome. The uneven countryside through which we passed held out no hopes; and the company we met that evening at the Cochrane Hotel (Hawker, Grieve, Raynham, Morgan, and various officials and newspaper correspondents) were unanimous in declaring that the only suitable patches of ground had been appropriated, and that we should find no others near St. John's.

At that time the American flying boats were at Trepassey, ready to start for the Azores, and most of the American correspondents had left St. John's to visit them.

The United States airship, NC.5, had flown to St. John's some days before our arrival. She came in a fog, after wandering over the neighbourhood of Newfoundland for some hours; having lost herself, it was reported, owing to an error of 180 deg. in the directional wireless bearings given her. She attracted great crowds, ourselves among them, to the bay. Later, we saw the airship steering an erratic course through the Gap, and mentally wished her commander good luck in his transatlantic ambitions. Soon afterwards we heard of her unfortunate break-away and total loss.

The departure of the NC flying boats sent great excitement into the small company of Britishers at the Cochrane Hotel. Hawker, Grieve, Raynham, and Morgan discarded caution, and, on hearing of the NC.4's arrival at the Azores risked exceedingly their chances of success by agreeing to start immediately, in a

whole-hearted and plucky effort to gain for Great Britain the honour of the first flight across the Atlantic. The result was disaster for Raynham and Morgan, whose small aerodrome was altogether unsuitable for a 'take-off' into the then wind, and magnificent failure for Hawker and Grieve, owing to a minor mishap to their engine.

Soon after the flight of the American craft I met Commander Byrd, U.S.N., designer of the bubble sextant for aerial navigation that bears his name. We had an interesting talk on the problems and difficulties of aerial navigation, and I tried to secure from Washington a Byrd sextant. The United States naval authorities promised to forward one from Washington, but, unfortunately, owing to transport difficulties, it reached St. John's after our departure. Nevertheless, I am very grateful to the U.S. Navy for its courtesy and its offer of help in an enterprise that was foreign to them, and non-official.

Newfoundland is a hospitable place, but its best friends cannot claim that it is ideal for aviation. The whole of the island has no ground that might be made into a first-class aerodrome. The district around St. John's is especially difficult. Some of the country is wooded, but for the most part it shows a rolling, switchback surface, across which aeroplanes cannot taxi with any degree of smoothness. The soil is soft and dotted with boulders, as only a light layer covers the rock stratum. Another handicap is the prevalence of thick fogs, which roll westward from the sea.

For about a week we continued the quest for a landing ground, and we must have driven over hundreds of miles of very bad road. Growing tired of hiring cars, we bought a second-hand Buick, which registered a total mileage of 400 miles at the time of purchase. Before long we were convinced that the speedometer must have been disconnected previous to the final 40,000 miles.

The best possibilities for an aerodrome were several level strips of meadowland, about a hundred yards wide by three hundred long; whereas the Vickers-Vimy, fully loaded, might need five hundred yards of clear run into the wind. Meanwhile, although

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disappointment accompanied us all over Newfoundland, the pacing out of fields provided good exercise.

The evenings were mostly spent in playing cards with the other competitors at the Cochrane Hotel, or in visits to the neighbouring film theatres. St. John's itself showed us every kindness. We explored the town pretty thoroughly, and were soon able to recognise parts of it with eyes closed and nostrils open, for its chief occupation appeared to be the drying of very dead cod.

Having heard rumours that suitable ground might be found at Ferryland, we motored there on May 18, and it was while returning from yet another disappointment that we learned of Hawker's disappearance into the Atlantic mists. Excitement and anxiety about the possible fate of Hawker and Grieve spread all the world over; but nowhere was it more intense than amongst us at the Cochrane Hotel, who had shared their hopes and discussed their plans. We were a gloomy crowd indeed until St. John's heard the sensational story of their rescue.

Raynham, meanwhile, although very disappointed after the setback that damaged his machine, kept alight the candle of hope and the torch of determination. Before it was possible to know whether or not Hawker had succeeded, he made arrangements for repair, and decided to try again.

He also invited Alcock and me to use his ground for erecting the Vickers-Vimy. A similar invitation was given by Captain Fenn, in charge of the Sopwith party. Neither aerodrome would be suitable for our final 'take off', but we accepted Raynham's very sporting offer, and arranged to build up the Vickers-Vimy, which was expected to arrive any day, on his aerodrome at Quidi Vidi, while continuing the search for a more suitable field.

Our mechanics arrived with machine and engines on May 26. We began erecting the Vickers-Vimy at once, working in the open air amid many obstacles and with much improvisation. Sheerlegs, for example, were constructed out of scaffolding poles. Raynham allowed the use of his hangar as a store.

All the Vickers party worked hard and cheerfully from early

dawn until dark, each man being on strenuous duty from twelve to fourteen hours a day. Two mechanics remained on guard each night, while the remainder drove to their billets. During the whole of this period of a thousand and one difficulties, each mechanic gave of his best, and I cannot pay too high a tribute to those men who laboured for us so competently and painstakingly, and yet received none of the glory. Even those who were but indirectly concerned in the venture searched for opportunities of helping us. The reporters representing the *Daily Mail*, the *New York Times*, and the *New York World* were often of assistance when extra manpower was required. But for one of the American reporters—Mr. Klauber—we should have been obliged to start without an electric torch when our own failed at the last moment.

It was, indeed, a nerve-edging time until the machine approached completion. Each day produced some new difficulty. Alcock kept his head and his temper admirably, however, and his intelligent supervision of the mechanics' work was an effective insurance against loss of time.

As the parts of the Vickers-Vimy grew into the semblance of a complete aeroplane, it attracted more and more visitors. Many rubbernecks, who seemed to have no other occupation, spent hours in leaning against the nearest fence and watching us. Soon we found it necessary to build a temporary enclosure around the machine; but even this did not keep the curious at a distance. Although we remained unworried so long as the crowd contented itself with just watching, we had to guard against petty damage. The testing of the fabric's firmness with the point of an umbrella was a favourite pastime of the spectators, and more than once we dispersed small parties whom we found leaning against the trailing edges, much as the Australian soldiers used to lean against the lamp-posts of the Strand. One man held a lighted cigar against a wing, and was annoyed when asked to keep at a distance.

We were still unsuccessful in our search for an aerodrome. One day a telegram arrived from a landowner in Harbour Grace, offering what he called an ideal aerodrome. Alcock raced off to inspect

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and secure it; but when he returned in the evening his one-sided grin told me that we were still out of luck. The 'ideal aerodrome' was a meadow about 150 by 300 yards—and the price demanded for its hire was £5,000, plus the cost of getting it ready, and an indemnity for all damage. Land *sells* in Newfoundland at 1s. 5d. an acre.

In despair, we approached Rear-Admiral Mark Kerr, who was in charge of the Handley-Page party, for permission to use his aerodrome. The Handley-Page Company had spent much money in preparations, and possessed the only flying ground in the country with any claim to practicability. The erection of their machine had begun at Harbour Grace before the arrival of the Vickers-Vimy. Major Gran, their navigator, and Major Taylor, their expert on meteorology and compasses, having lived with us at the Cochrane Hotel. We were on good terms with both of them, and Taylor and I had exchanged ideas on aerial navigation.

The advance party for the Boulton and Paul machine also tendered to Rear-Admiral Kerr a request for permission to make use of his aerodrome, and they and we received a joint answer. If, said Admiral Kerr, each party paid half the cost of the aerodrome, we might have the use of it *after* the Handley-Page machine had left on its flight across the Atlantic. Very naturally we refused, and we could not but contrast this suggestion with the sporting attitude of Raynham and Hawker.

Soon afterwards a local inhabitant—Mr. Lester, who had done all our carting—offered us a field under more reasonable conditions, at a place called Monday's Pool. We found it to be a large meadow, half on a hill and with a swamp at the bottom. It possessed, nevertheless, a level surface of about 300 yards, running east and west.

We examined and paced out four other fields on the hilltop, and found that by taking them in we could obtain a full run of five hundred yards. The owner of this additional ground wanted extortionate prices for its use, but after much haggling we closed a deal with them. Thirty labourers, with pick and shovel, set to work

to prepare the aerodrome by removing hillocks, blasting boulders, and levelling walls and fences. Finally, it was completed, well within the time for the trial flight.

During the first few days spent on the erecting of the machine there was little for me to do. I unpacked and verified wireless and navigation equipment, and, having rigged up a receiving station on the roof of the Cochrane Hotel, with the consent and help of Lieut. Clare, of the Mount Pearl Naval Wireless Station, I practised sending and receiving wireless messages, and tuning in on various wave-lengths.

Rain and high wind were responsible for a delay of three days, during which the machine necessarily remained in the open, with tarpaulins over the engines, and only a small wind-screen to break the force of the gales. When better conditions arrived, the body of the Vickers-Vimy grew slowly into the semblance of a complete aeroplane, spurred thereto by our impatience and the willing work of the mechanics. The wings being in place, the Rolls-Royce experts became busy, examining and checking every little detail of their engines, so that there should be no avoidable trouble on that account. Water for the radiator was filtered, and then boiled in a steel barrel.

Our day-to-day watchers from St. John's showed much interest in this boiling process, and asked many questions. They seemed content with our explanation that we were boiling the petrol so as to remove all water. Several asked whether we filled the planes with gas to make them lighter. Others were disappointed because we did not intend to drop our under-carriage, as Hawker had done, and prophesied that such neglect would lead to failure.

The machine was ready to take the air on the morning of Monday, June 9, and we decided to make the first flight that same afternoon. We had meant to keep the news of the forthcoming trial as secret as possible, so as to avoid a crowd. It leaked out, however, and long before the engines were warmed up and tested a large gathering had collected at Quidi Vidi. The weather was on its best behaviour, and our take off from the ground was perfect in

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every way. Under Alcock's skilful hands the Vickers-Vimy became almost as nippy as a scout.

We headed directly westward, and passed over the sea for some fifteen minutes. The day was clear, and the sea reflected the sky's vivid blue. Near the coast it was spotted and streaked by the glistening white of icebergs and whitecaps.

Trial observation with my navigation instruments proved them to be O.K., but not a spark could be conjured from the wireless. The machine and engines seemed in perfect condition.

Alcock turned the Vickers-Vimy, and brought us back over St. John's at a height of 4,000 feet. Newfoundland from above looked even more bleak and rugged than it did from the ground; and we saw that landing grounds would be impossible on the eastern side of it. We were to descend on the new aerodrome. This we discovered by means of a smudge-fire, lighted as a signal. Alcock made a perfect landing up the hill. The Vimy ran on, topped the brow, and was heading straight for a fence on the roadside, when the pilot saved a collision by opening up the starboard engine, which swung the craft round before she came to a standstill.

We pushed the machine down the hill to the most sheltered part of the field, pegged it down, and roped off a space round it, to keep spectators at a safe distance. The proposed hangar was unfinished, so that the Vickers-Vimy still remained in the open.

I dismounted the wireless generator for examination, and next day took it to Mount Pearl wireless station, where Lieutenant Clare helped me to locate the fault and to remedy it.

A far more serious worry now confronted us. The fuel we had intended to carry was a mixture of petrol and benzol, sent from England. On examination we found in it a peculiar precipitate, like a very soft resin. It was sticky, and had the consistency of india rubber wetted by petrol. When dry it reduced to a powder. Naturally, we could not afford the risk of letting such a deposit clog our filters, and perhaps, owing to stoppage of fuel supply, cause engine failure—that bugbear of every aviator who flies over long distances. It was not definitely proved that the precipitate

resulted from the mixture of petrol and benzol; but so much depended on satisfactory fuel that we dared use none that was doubtful, and we decided to substitute pure petrol for the mixture. The problem was how to find enough of the quality required—Shell B. Raynham, as much of a sportsman as ever, put his spare stock at our disposal; but fortunately, a newly-arrived ship brought enough for our needs.

Mr. P. Maxwell Muller, who had organised our transatlantic party, also came on this boat. He is a rabid optimist, with the power of infecting others with his hopefulness; and we were glad indeed to see him, and especially to turn over to him such matters as unpaid bills.

The second trial flight took place on June 12. Once again the wireless apparatus was the single unsatisfactory item. The transmitter worked well for a time, but afterwards the insulation in the transmitter failed, giving me a violent shock. After a short flight Alcock made a satisfactory landing.

By now we were besieging Lieutenant Clements, the meteorological officer, for weather reports. Besides his own work, he had undertaken the duties of Major Partridge, official starter for the Royal Aero Club, and therefore he had to place the club's official seal on the Vickers-Vimy. This he did without any superfluous ceremony, his seal insuring that we should not cheat by flying from Newfoundland in one aeroplane and landing in Ireland in another.

At that period the weather reports, such as they were, indicated fairly favourable conditions for the flight. At no time were the reports complete, owing to the delays in transmission, although Clements made the very best of the meagre data at his disposal.

We saw the Handley-Page making its initial flights; but we hoped to leave on Friday, June 13, and thus show it the way across the Atlantic. We worked at high speed on several last-minute jobs. The compasses were swung, the wireless apparatus repaired, more elastic shock-absorbers were wrapped round the axles, and the navigating instruments were taken on board, with food and emergency supplies.

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But with all the hurry and bustle we found that everything could not be ready by Friday, the 13th, and that a postponement until 4 a.m. on the Saturday was essential.

By Friday evening the last coat of dope was dry, and nothing had been overlooked. The only articles missing were some life-saving suits, which we were expecting from the United States. Long afterwards we discovered that these had been delivered to the Bank of Montreal, whose officials, believing that the case contained typewriters, stored it in their cellars.

Alcock and I went to bed at 7 p.m., while the mechanics remained all night with the machine, completing the filling of the tanks, and moving it to the position chosen for the start.

We were called before dawn, and joined them on the aerodrome at 3.30 a.m. on June 14.

CHAPTER THREE

The Start

A LARGE black cat, its tail held high in a comical curve, sauntered by the transatlantic machine, early on the morning of June 14, and such a cheerful omen made me more than ever anxious to start.

Two other black cats—more intimate if less alive—waited in the Vickers-Vimy. They were Lucky Jim and Twinkletoe, our mascots, destined to be the first air passengers across the Atlantic. Lucky Jim wore an enormous head, an untidy ribbon, and a hopeful expression; whereas Twinkletoe was dainty and diminutive, and, from the tip of her upright tail to the tip of her stuffed nose, expressed surprise and anxiety. Other gifts that we carried as evidence of our friends' best wishes were bunches of white heather.

'Strong westerly wind. Conditions otherwise fairly favourable.'

Such was the brief summary of the weather conditions given us at 4 a.m. by the meteorological officer. We had definitely decided to leave on the 14th, if given half a chance, for at all costs we wanted to avoid a long period of hope deferred while awaiting ideal conditions.

At early dawn we were on the aerodrome, searching the sky for a sign, and asking information of Lieutenant Clements, the Royal Air Force weather expert. His reports were fairly favourable; but a hefty cross-wind was blowing from the west in uneven gusts, and everybody opined that we had better wait a few hours, in the expectation that it would die down.

Meanwhile, Alcock ran the engines, and found them to be in perfect condition. Neither could any fault be found with the grey-winged machine, inert but fully loaded, and complete to the last split-pin.

Our Transatlantic Flight

It was of the standard type of Vickers-Vimy bomber; although, of course, the bombs and bombing gear were not carried, their weight being usefully replaced by extra storage tanks for petrol. One of these, shaped like a boat, could be used as a life-saving raft if some accident brought about a descent into the sea. This tank was so placed that it would be the first to be emptied of petrol. The fittings allowed of its detachment, ready for floating, while the machine lost height in a glide. We hoped for and expected the best; but it was as well to be prepared for the worst.

To make communication and co-operation more easy, the seats for both pilot and navigator were side by side, in what is usually the pilot's cockpit, the observer's cockpit at the fore-end of the fuselage being hidden under a stream-lined covering, and occupied by a tank.

The tanks had been filled during the night, so that the Vickers-Vimy contained its full complement of 870 gallons of petrol and 40 gallons of oil. We now packed our personal luggage, which consisted only of toilet kit and food—sandwiches, Caley's chocolate, Horlick's Malted Milk, and two thermos flasks filled with coffee. A small cupboard, fitted into the tail, contained emergency rations, as in case of disaster that part of the aeroplane would remain clear of the waves for a long while after the nose had submerged. Our mascots, also, were in this cupboard.

The mail-bag had been taken on board a day earlier. It contained 300 private letters, for each of which the postal officials at St. John's had provided a special stamp. For one of these stamps, by the way, £175 was offered and refused on the Manchester Exchange within two days of the letter's delivery. They are now sold at about £25 apiece, I believe.

We breakfasted, and throughout the morning we waited for a weakening of the wind. As, however, it remained at about the same strength, and showed no signs of better behaviour, we made up our minds to leave at mid-day.

We had planned to take off in an easterly direction; for, although we should thus be moving with the wind instead of into it, the

The Start

machine would face down-hill, and, owing to the shape of the aerodrome, we should have a better run than if we taxied towards the west. The Vickers-Vimy, therefore, was placed in position to suit these arrangements.

But soon we found that the gale was too strong for such a plan, and that we should have to take off into it. The mechanics dragged the machine to the far end of the aerodrome, so as to prepare for a westerly run. This change was responsible for a minor set-back. A sudden gust carried a drag rope round the under-carriage, tightened one of the wheels against a petrol supply pipe, and crushed it. The consequent replacement wasted about an hour.

Still with hopes that the gale would drop during the early afternoon, we sat under the wing-tips at two o'clock and lunched, while conscious of an urgent hope that our next square meal would be eaten in Ireland.

The wind remained obstinately strong during the early afternoon, and we agreed to accept the conditions as they were, and to lose no more precious time. At about four o'clock we wriggled into our flying-kit, and climbed into the machine. We wore electrically heated clothing. Burberry overalls, and the usual fur gloves and fur-lined helmets.

While Alcock attended to his engines I made certain that my navigation instruments were in place. The sextant was clipped to the dashboard facing the pilot, the course and distance calculator was clasped to the side of the fuselage, the drift indicator fitted under the seat, and the Baker navigation machine, with my charts inside it, lay on the floor of the cockpit. I also carried an electric torch, and kept within easy reach a Verey pistol, with red and white flares, so that if the worst should happen we could attempt to attract the attention of passing ships. The battery for heating our electric suits lay between the two seats.

The meteorological officer gave me a chart showing the approximate strength and direction of the Atlantic air currents. It indicated that the high westerly wind would drop before we were a hundred miles out to sea, and that the wind velocities for the rest of the

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journey would not exceed twenty knots, with clear weather over the greater part of the ocean. This produced satisfactory hopes at the time; but later, when we were over mid-Atlantic, they dissolved in disappointment when the promised 'clear weather' never happened.

The departure was quiet and undramatic. Apart from the mechanics and a few reporters, few people were present, for the strong wind had persuaded our day-to-day sightseers from St. John's that we must postpone a start. When all was ready I shook hands with Lieutenant Clements, Mr. Maxwell Muller, and other friends, accepted their best wishes for success, and composed myself in the rather crowded cockpit.

The customary 'Contact!' from the mechanic seemed, perhaps, to have a special momentary significance, but my impatience to take the plunge and be rid of anxiety about the start shut out all other impressions different from those at the beginning of each of the thousand and one flights I had made before the transatlantic venture.

First one and then the second engine came to life, swelled into a roar when Alcock ran them up, softened into a subdued murmur when he throttled back and warmed them up. Finally, everything being satisfactory, he disconnected the starting magnetos and engine switches, to avoid stoppage due to possible short-circuits, and signalled for the chocks to be pulled clear. With throttles open, and engines all out, the Vickers-Vimy lumbered into the westerly wind.

The 'take off' up a slight gradient, was very difficult. Gusts up to 5 knots were registered, and there was insufficient room to begin the run dead into the wind. What I feared in particular was that a sudden eddy might lift the planes on one side and cause the machine to heel over. Another danger was the rough surface of the aerodrome.

Owing to its heavy load, the machine did not leave the ground until it had lurched, at an ever-increasing speed, over 300 yards. We were then almost at the end of the ground-tether allowed us.



Manhandling the plane to the top of the airstrip for the first test flight.

Front view of the Vimy ready for the test flight.





Alcock and Brown dressed in full flying kit.

The Start

A line of hills on either side were responsible for much 'bumpiness' in the atmosphere, and made climbing very difficult. At times the strong wind dropped almost to zero, then rose again in an eddying blast. Once or twice our wheels nearly touched the ground again.

Under these conditions we could climb but slowly, allowing for the danger of sudden upward gusts. Several times I held my breath, from fear that our under-carriage would hit a roof or a tree-top.

I am convinced that only Alcock's clever piloting saved us from such an early disaster. When, after a period that seemed far longer than it actually was, we were well above the buildings and trees, I noticed that the perspiration of acute anxiety was streaming down his face.

We wasted no time and fuel in circling round the aerodrome while attaining a preliminary height, but headed straight into the wind until we were at about eight hundred feet. Then we turned towards the sea, and continued to rise leisurely, with engines throttled down. As we passed the aerodrome, I leaned over the side of the machine and waved farewell to the small crowd.

The Vickers-Vimy, although loaded to the extent of about eleven pounds per square foot, climbed satisfactorily, if slowly. Eight minutes passed before we had reached the thousand feet level.

Between St. John's and Concepción Bay the air was very bumpy, and not until we reached the coast and were away from the uneven contours of Newfoundland did it become calmer. The eddying wind, which was blowing behind us from almost due west, with a strength of 35 knots, made it harder than ever to keep the machine on a straight course. The twin engine Vickers-Vimy is not especially sensitive to atmospheric instability, but under the then conditions it lurched, swayed, and did its best to deviate, much as if it had been a little single-seater.

We crossed the coast at 4.28 p.m. (Greenwich time), our aneroid then registering about 1,200 feet. Just before we left the land I

Our Transatlantic Flight

let out the wireless aerial, and tapped out on the transmitter key a message to Mount Pearl Naval Station: 'All well and started.'

My mind merely recorded the fact that we were leaving Newfoundland behind us. Otherwise, it was too tense with concentration on the task ahead to find room for any emotions or thoughts on seeing the last of the square-patterned roof-mosaic of St. John's, of the tangled intricacy of Newfoundland's fields, woods, and hills. Behind and below was America, far ahead and below was Europe, between the two was nearly 2,000 miles of ocean. But at the time, I made no such stirring, if obvious, reflection; for my navigation instruments and charts, as applied to sun, horizon, sea-surface, and time of day, demanded my close and undivided attention.

Withal, I felt a queer but quite definite confidence in our safe arrival over the Irish coast; based, I suppose, on an assured knowledge that the machine, the engines, the navigating instruments, and the pilot were all first-class.

The Vickers-Vimy shook itself free from the atmospheric disturbance over the land, and settled into an even progress through the calmer spaces above the ocean. The westerly wind behind us, added to the power developed by the engines, gave us a speed along our course (as opposed to air speed) of nearly 140 knots.

Visibility was fairly good during the first hour of the flight. Above, at a height of something between two thousand and three thousand feet, a wide ceiling of clouds was made jagged at fairly frequent intervals by holes, showing spots of blue sky. Below, the sea was blue-grey, dull for the most part but bright in occasional patches, where the sunlight streamed on it through some cloud-gap. Icebergs stood out prominently from the surface, in splashes of glaring white.

I used all my faculties in setting and keeping to the prescribed course. The Baker navigating machine, with the chart, lay on my knees. Not knowing what kind of weather was before us, I knelt on the seat, and made haste to take observations on the sea, the horizon, and the sun, through intervals in the covering of clouds.

The Start

The navigation of aircraft in its present stage, is distinctly more difficult than the navigation of seacraft. The speed of an aeroplane, and the influence of the wind, introduce problems that are not easily solved. A ship's navigator knows to a small fraction of a mile the set of any ocean current, and from the known speed of his vessel, he can keep 'dead reckoning' with an accuracy that is nearly absolute. In fact, navigators have taken their craft across the Atlantic without a glimpse of the sun or stars, and yet, at the end of the journey, have been within five miles of the desired destination. But in the air the currents either cannot be, or have not yet been, charted, and a navigator's allowance for the drift resulting from them must be obtained by direct observation on the surface of the ocean.

By the same means his actual speed over the ocean may be calculated. He finds the position of his craft by measuring the angle which either the sun or a selected star makes with the horizon, and then noting the Greenwich mean time at which the observation is made. If the bearings of two distinct wireless stations can be taken he can check his definite position by means of directional wireless.

When making my plans for the transatlantic flight, I considered very carefully all the possibilities, and decided to rely solely upon observations of the sun and stars and upon 'dead reckoning', in preference to using directional wireless; for at the time I was uncertain whether or not the direction wireless system was sufficiently reliable.

My sextant was of the ordinary marine type, although it had a more heavily engraved scale than is usual, so as to make easier the reading of it amid the vibration of the aeroplane. My main chart was on the Mercator projection, and I had a special transparent chart which could be moved above it, and upon which were drawn the Sumner circles for all times of the day. I took with me a similar special chart for use at night, giving the Sumner circles for six chosen stars. To measure the drift I had a six-inch Drift-Bearing plate. Besides its ordinary use, this enabled me to measure the

Our Transatlantic Flight

ground speed, with the help of a stop-watch. In addition, I carried an Appleyard course and distance calculator, and also Traverse tables for the calculation of 'dead reckoning'.

As the horizon is often obscured by clouds or mist, making impossible the measurement of its angle with the heavenly bodies, I had a special type of spirit level, on which the horizon was replaced by a bubble. The bubble, of course, was less reliable than a true horizon, being affected by variations of speed, but it was at least a safeguard. Taking into account the general obscurity of the atmosphere during most of the flight it was fortunate that I took such a precaution, for I seldom caught sight of a clearly-defined horizon.

I could congratulate myself legitimately on having collected as many early observations as possible, while the conditions were yet good; for soon we ran into an immense bank of fog, which shut off completely the surface of the ocean. The blue of the sea merged into a hazy purple, and then into the duller kind of grey.

The cloud screen above us thickened, and there were no more gaps in it. The occasional sun-glints on wing-tips and struts no longer appeared.

I could thus obtain neither observation on the sun, nor calculations of drift from the sea. Assuming that my first observations were satisfactory, I therefore carried on by 'dead reckoning', and hoped for the best. From time to time I varied the course slightly, so as to allow for the different variations of the compass.

Meanwhile, while we flew through the wide layer of air sandwiched between fog and cloud, I began to jot down remarks for the log of the journey. At 5.20 I noted that we were at fifteen hundred feet, and still climbing slowly, while the haze grew ever thicker and heavier.

I leaned towards the wireless transmitter, and began to send a message. Thereupon the small propeller on the generator snapped suddenly and broke away. Careful examination, both at the time and after we landed, showed no defect, and I am still unable to account for the fracture. Although I was too occupied with calcula-

The Start

tions to pay much attention to moods or passing thoughts, I remember feeling that this cutting off of all means of communication with the life below and behind us gave a certain sense of finality to the adventure.

We continued eastward, with the rhythmic drone of the engines unnoted in supreme concentration on the hours that were to come.

CHAPTER FOUR

Evening

FOR a time, Alcock and I attempted short conversations through the telephone. Its earpieces were under our fur caps, and round our necks were sensitive receivers for transmitting the throat vibrations that accompany speech. At about six o'clock Alcock discarded his earpieces because they were too painful, and for the rest of the flight we communicated in gestures and scribbled notes.

I continued to keep the course by 'dead reckoning', taking into account height, compass bearing, strength of wind, and my previous observations. The wind varied quite a lot, and several times the nose of the Vickers-Vimy swayed from the right direction, so that I had to make rapid mental allowances for deviation.

The results I made known to Alcock by passing over slips of paper torn from my notebook. The first of these was the direction: 'Keep her nearer 120 than 140.'

The second supplied the news that the transmitter was useless: 'Wireless generator smashed. The propeller has gone.'

Throughout the evening we flew between a covering of unbroken cloud and a screen of thick fog, which shut off the sea completely. My scribbled comment to the pilot at 5.45 was: 'I can't get an obs. in this fog. Will estimate that same wind holds and work by dead reckoning.'

Despite the lack of external guidance, the early evening was by no means dull. Just after six the starboard engine startled us with a loud, rhythmic chattering, rather like the noise of machine-gun fire at close quarters. With a momentary thought of the engine trouble that had caused Hawker and Grieve to descend in mid-Atlantic, we both looked anxiously for the defect. This was not

Evening

hard to find. A chunk of exhaust pipe had split away, and was quivering before the rush of air like a reed in an organ pipe. It became first red, then white hot, and softened by the heat, it gradually crumpled up. Finally, it was blown away, with the result that three cylinders were exhausting straight into the air, without any guidance through the usual outlet.

The chattering swelled into a loud, jerky thrum, much more prominent than the normal noise of a Rolls-Royce aero engine. This settled down to a steady and continuous roar. Until we landed nothing could be done to the broken exhaust pipe, and we had to accept it as a minor disaster, unpleasant but irremediable. Very soon my ears had become so accustomed to the added clamour that it passed unnoticed.

I must admit, however, that, although my mind contained no room for impressions dealing with incidents not of vital importance, I was far from comfortable when I first observed that a little flame licking outward from the open exhaust, was playing on one of the cross-bracing wires, and had made it red-hot. This trouble could not be lessened by throttling down the starboard engine, as in that case we should have lost valuable height.

The insistent hum of the engines made the solitude seem more normal. The long flight would have been dreadful had we made it in silence; for, shut off as we were from sea and sky, it was a very lonely affair. The spreading fog enveloped the Vickers-Vimy so closely that our sheltered cockpit suggested an isolated but by no means cheerless room.

Moisture condensed on goggles, dial glasses, and wires when, at about seven, we rose through a layer of clouds on the 2,000 feet level. Alcock wore no goggles, by the way, and I made use of mine only when leaning over the side of the fuselage to take observations.

Emerging into the air above the clouds I looked upward, and found another stretch of cloud-bank still higher, at 5,000 feet. We thus remained cut off from the sun. Still guided only by 'dead

NAVIGATION LOG

AIRCRAFT. VICKERS VIMY DATE 14-15 June 1919 NAVIGATOR Lt. A.W. BROWN SHEET No. 1

TIME G.M.T.	TRUE LOCAL	WAVE W	DEV.	COM.	OBSERVATIONS.	ALT.	TAS.	WIND SPEED	WIND DIRECTION	WIND GUST	WIND GUST	WIND GUST
16124	240735				A/B St. JOHNS	Message to BZM						
1620	078 220730	078	30	108	S/C GAL W/LAY	Windy strong and gusty Weather Cloudy	70	1000		120		
1628					From 47.30 N 52.30 W	Over coast		1200				
1654								1600		120		
1702					Pre-computed	Could not get sun Sun alt. 56.14						
1720	078		30	124	D.R. posn 47.52 N	Impossible to get 50.00 W. obs. of sun between fog and high clouds.	70	1500		104		
1820	078	084	31	124	D.R. posn 48.16 N	Cloud above and 47.00 W. below readings impossible.	65			120224		
1820	078 11 R	083	31	120	D.R. posn 48.37 N	Climbing but still 44.32 W. no chance of signs	65	3000		100324		
1840						Wireless busy no message for us yet. We have 4 hours yet to climb (so darkness)						
2020	078		31	120	D.R. posn 48.54 N	Too cloudy for 42.32 W. drift obs. nations	65	4500		80404		
2031					Fix 49.30 N	by Sun Obs alt 17.50 38.35 W. and D.R.				143580		
2120						Dense cloud above and below Sun obs shows that D.R. is badly out.						
2220	078		29	120	D.R. posn 50.23 N	This seems to be 32.00 W. too far away from No obs. and D.R. apparently out.	3600			140834		
2260						Someone is trying to talk but is being jammed						
2320	078			116		Climbing to get above clouds for star fixes. No signs up to present	65	6200				
June 12 0017					Vega Obs alt 67.30	Ship cleared 49.40: R = +2.7 Practically no ship on cloud horizon not far below						

NAVIGATION LOG

AIRCRAFT VICKERS VMVY DATE 15 June 1919 NAVIGATOR Lt. A.W. BROWN SHEET No. 2

TIME	WIND	TRUE	WIND	FLC	COMP	OBSERVATIONS	BAR	ALT	TEMP	TAS	CH	DEF	TIME	ETA
0000	USED	HEADING	WIND	PERCENT	HEADING		ALT.							
20077		23	120			D.R. from 5230W. This does not agree 12.00W. with sun P.L.	65	11000					20	149
						Occasional glimpse of sun still burning Thick cloud and sheet D.R. shows north of track								
55						Dropped to 1000 with starboard engine stopping. Drift signals on waves gave W/V 1530K along track of 075 at 110 T.A.S.		1000						
300			160			A/C								
						Don't be afraid of S. we have too much N. already.								
126		20	170			From star signals we must be about 64.00W. 1030W. S/C for GALWAY								
20						In sight of SW of F.SHEL and Jurass Isles								
326						Crossed coast probably N. Ireland. Can you carry on and go further S? Follow up.							703	
						Coast to coast time 1557 hrs.								
340						Landed CLIFDEN								1830
						Flying time 1628 hrs.								

Our Transatlantic Flight

reckoning', the Vickers-Vimy continued along the air-way between a white cloud-ceiling and a white cloud-carpet.

I was very anxious for an opportunity to take further observations, either on the sun or on the stars, so as to check the direction by finding our correct position. At 7.40 I handed Alcock the following note: 'If you get above clouds we will get a good fix tonight and hope for clear weather tomorrow. Not at any risky expense to engines though. We have four hours yet to climb.'

The altimeter was then registering 3,000 feet.

All this while I had listened occasionally for wireless messages, as the receiver was still in working order. No message came for us, however, and the only sign of life was when at 7.40, I heard somebody calling 'B.M.K.' Even that slight sign of contact with life below cheered me mightily.

Throughout the journey, we had no regular meals, but ate and drank in snatches, whenever we felt so inclined. It was curious that neither of us was hungry at any time during the sixteen hours of the flight, although now and then I felt the need of something to drink.

The food was packed into a little cupboard behind my head, on the left-hand side of the fuselage. I reached for it at about 7.30, and, deciding that Alcock must need nourishment, I passed him two sandwiches and some chocolate, and uncorked the thermos flask. He made use of only one hand for eating and drinking, keeping the other on the joystick.

We happened on a large gap in the upper layer of clouds at half-past eight. Through it the sun shone pleasantly, projecting the shadow of the Vickers-Vimy on to the lower layer, over which it darted and twisted, contracting or expanding according to the distortions on the cloud surface.

I was able to maintain observation on the sun for some ten minutes. The calculations thus obtained showed that if we were still on the right course the machine would be further east than was indicated by 'dead reckoning'. From this I deduced that the strength of the wind must have increased rather than fallen off, as

Evening

had been prophesied in the report of the meteorological expert at St. John's. The supposition was borne out by the buffetings which, from time to time, swayed the Vickers-Vimy. Up till then our average speed had been 143 knots.

I got my observations of the sun while kneeling on the seat and looking between the port wings. I was obliged to bring the spirit level into play, as the horizon was invisible, and the sextant could not be used.

Later, I caught sight of the sea for a few brief moments, and at 9.15 I wrote the following note to Alcock: 'Through a rather bad patch I have just made our ground speed 140 knots, and from the sun's altitude we must be much further east and south than I calculated.'

I continued to keep a log of our movements and observations, and at 9.20 p.m. made the following entry: 'Height 4,000 feet. Dense clouds below and above. Got one sun observation which shows that "dead reckoning" is badly out. Shall wait for stars and climb. At 8.31 position about 49 deg. 31 minutes north, 38 deg. 35 minutes west.'

The clouds above remained constant, at a height of about 5,000 feet. I was eager to pass through them before the stars appeared; and at 9.30, when the light was fading, I scribbled the enquiry: 'Can you get above these clouds at, say, 60 deg.? We must get stars as soon as poss.'

Alcock nodded, and proceeded to climb as steeply as he dared.

Twilight was now setting in, gradually but noticeably. Between the layers of cloud the daylight, although never very good, had until then been strong enough to permit readings of the instruments and chart. At ten o'clock these were impossible without artificial light.

For my chart I now used an electric lamp. I switched on the tiny bulb that illuminated the face of the compass. All the other fixed instruments were luminous in themselves. For my intermittent inspection of the engines I had to flash the electric torch over either side of the cockpit.

Our Transatlantic Flight

The clouds, both above and below, grew denser and darker. One could now see them only as indefinite masses of nebulousness, and it became more and more difficult to judge how near to, or how far from them we were. An entry in my log, made at 10.20, says, 'No observations, and dead reckoning apparently out. Could not get above clouds for sunset. Will wait check by stars.'

An hour later we had climbed to 5,200 feet; but still we found clouds above us. We continued to rise, so as to be above them in time for some early observations on the stars.

It was now quite dark. As we droned our isolated way eastward and upward, nothing could be seen outside the cockpit, except the inner struts, the engines, the red-glowing vapour ejected through the exhaust pipes, and portions of the wing-surface, which glistened faintly in the moon-glimmer.

I waited impatiently for the first sight of the moon, the Pole Star and other old friends of every navigator.

CHAPTER FIVE

Night

MIDNIGHT came and went amid sullen darkness, modified only by dim moonlight and the red radiance that spurted from the engines' exhaust pipes.

By then we must have climbed to about 6,000 feet, although my log shows no record of our height at this stage. Meanwhile, we were still between upper and lower ranges of cloud banks.

At a quarter past twelve Alcock took the Vickers-Vimy through the upper range, only to find a third layer of clouds, several thousand feet higher. This, however, was patchy and without continuity, so that I was able to glimpse the stars from time to time.

At 12.25 I identified, through a gap to north-eastward, the star Vega, which shone very brightly high in the heavens, and the Pole Star. With their help, and that of a cloud horizon, which was clearly defined in the moonlight, I used the sextant to fix our position.

This, I found, was latitude 50 deg. 7 minutes N., and longitude 31 deg. W., showing that we had flown 850 nautical miles at an average speed of 106 knots. We were slightly to the south of the correct course, which fact I made known to Alcock in a note, with pencilled corrections for remedying the deviation.

Most of my 'dead reckoning' calculations were short of our actual position, I discovered. The reason was that, influenced by meteorological predictions based on the weather reports at St. John's, I had allowed for a falling off in the strength of the wind, which had not occurred.

Having found the stars and checked our position and direction, the urgent necessity of continuing to climb no longer existed.

Our Transatlantic Flight

Alcock had been nursing his engines very carefully, and to reduce the strain on them, he now let the machine lose height slowly. At 1.20 a.m. we were down to 4,000 feet, and an hour later we had dropped yet 400 feet lower.

The clouds overhead were still patchy, clusters of stars lightening the intervals between them. But the Vickers-Vimy, at its then height, was moving through a sea of fog, which prevented effective observation. This I made known to the pilot in a message: 'Can get no good readings. Observation too indefinite.'

The moon was in evidence for about an hour and a half, radiating an uneven glow over the semi-darkness, and tinging the cloud-tips with variations of silver, gold, and soft red. Whenever directly visible, it threw the moving shadows of the Vickers-Vimy on to the clouds below.

Looking over the machine's starboard planes, I tried several times to sight the moon for latitude, but the horizon was always too indefinite.

An aura of unreality seemed to surround us as we flew onward, towards the dawn and Ireland. The fantastic surroundings impinged on my alert consciousness as something extravagantly abnormal—the distorted ball of a moon, the eerie half-light, the monstrous cloud shapes, the fog below and around us, the misty indefiniteness of space, the changeless drone, drone, drone of the engines.

To take my mind from the strangeness of it all, I turned to the small food cupboard at the back of the cockpit. Twice during the night we drank and ate in snatches, Alcock keeping a hand on the joystick, while using his other to take the sandwiches, chocolate, and thermos flask, which I passed to him one at a time.

Outside the cockpit was bitter cold, but inside was well-sheltered warmth, due to the protective wind-screen, the nearness of the radiator, and our thick clothing. Our only physical discomfort resulted from the impossibility of any but cramped movements. It was a relief even to turn from one engine to the other, when examining them by the light of my electric torch.

Night

After several hours in the tiny dimensions of the cockpit, I wanted to kick out, to walk, to stretch myself. For Alcock, who never removed his feet from the rudder-bars, the feeling of restiveness must have been painfully uncomfortable.

It was extraordinary that during the sixteen hours of the flight, neither Alcock nor I felt the least desire for sleep. During the war, pilots and observers of night-bombing craft, their job completed, often suffered intensely on the homeward journey from the effort of will necessary to fight the drowsiness induced by the relaxed tension and the monotonous, never-varying hum of the engine—and this after only four to six hours of continuous flying. Probably, however, such tiredness was mostly reaction and mental slackening after the object of their journeys—the bombing of a target—had been achieved. Our own object would not be achieved until we saw Ireland beneath us, and it could not be achieved unless we kept our every faculty concentrated on it all the time. There was, therefore, no mental reaction during our long period of wakeful flying over the ocean.

We began to think about sunrise and the new day. We had been flying for over ten hours; and the next ten would bring success or failure. We had more than enough petrol to complete the long journey, for Alcock had treated the engines very gently, never running them all out, but varying the power from half to three-quarter throttle. Our course seemed satisfactory, and the idea of failure was concerned only with the chance of engine mishap, such as had befallen Hawker and Grieve, or of something entirely unforeseen.

Something entirely unforeseen did happen. At about sunrise—3.10 a.m. to be exact—when we were between 3,500 and 4,000 feet, we ran into a thick bank that projected above the lower layer of cloud. All around were dense drifts of vapour, which even cut off from our range of vision the machine's wing-tips and the fore-end of the fuselage.

The development was entirely unexpected; and, separated suddenly from external guidance, we lost our instinct of balance. The

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machine, left to its own devices, swung, flew amok, and began to perform circus tricks.

Until we should see either the horizon or the sky or the sea, and thus restore our sense of the horizontal, we could tell only by the instruments what was happening to the Vickers-Vimy. Unless there be outside guidance, the effect on the augean canal in one's ears of the centrifugal force developed by a turn in a cloud causes a complete loss of dimensional equilibrium, so that one is inclined to think that an aeroplane is level even when it is at a big angle with the horizontal. The horizontal, in fact, seems to be inside the machine.

A glance at the instruments on the dashboard facing us made it obvious that we were not flying level. The air speed crept up to ninety knots while Alcock was trying to restore equilibrium. He pulled back the control lever; but apparently the air-speed meter was jammed, for although the Vickers-Vimy must have nosed upwards, the reading remained at ninety.

And then we 'stalled'. The Vickers-Vimy hung motionless for a second, while our speed dropped below the minimum necessary for heavier-than-air flight; after which it heeled over and fell into what was either a spinning nose-dive or a very deep spiral.

The compass needle continued to revolve rapidly, showing that the machine was swinging as it dropped; but, still, hemmed in as we were by the thick vapour, we could not tell how or in which direction we were spinning. Before Alcock could reduce the throttle, the roar of the engines had almost doubled in volume, and instead of the usual 1,650 to 1,700 revolutions, they were running at about 2,200 per minute. The pilot throttled down, and the vibration ceased.

Apart from the changing levels marked by the aneroid, only the fact that our bodies were pressed tightly against the seats indicated that we were falling. How and at what angle we were falling, we knew not. Alcock tried to centralise the controls, but failed because we had lost all sense of what was central. I searched in every direction for an external sign, and saw nothing but opaque nebulousness.



Owing to high winds, take off was delayed until the afternoon, allowing time for this picnic lunch. The centre figure in the trilby hat is Maxwell Muller.
Below: A final check is made on equipment—the plane was identified by official seals.





Captain Alcock stows his Ferrostat Vacuum Flask, 'a wonderful contrivance out of which we had hot drinks long after our arrival in Ireland.'

Night

The aneroid, meantime, continued to register a height that dropped ever lower and alarmingly lower—3,000, 2,000, 1,000, 500 feet. I realised the possibility that we might hit the ocean at any moment if the aneroid's exactitude had been affected by differences between the barometric conditions of our present position and those of St. John's, where the instrument was set.

A more likely danger was that our cloud might stretch down as far as the surface of the ocean, in which case Alcock, having obtained no sight on the horizon, would be unable to counteract the spin in time.

I made ready for the worst, loosening my safety belt and preparing to salve my log of the flight. All precautions would probably have been unavailing, however, for had we fallen into the sea, there would have been small hope of survival. We were on a steep slant, and even if we escaped drowning when first submerged, the dice would be heavily loaded against the chance of rescue by a passing ship.

And then, while these thoughts were chasing each other across my mind, we left the cloud as suddenly as we had entered it. We were now less than a hundred feet from the ocean. The sea surface did not appear below the machine, but, owing to the wide angle at which we were tilted against the horizontal, seemed to stand up level, sideways to us.

Alcock looked at the ocean and the horizon, and almost instantaneously regained his mental equilibrium in relation to external balance.

Fortunately the Vickers-Vimy manoeuvres quickly. It responded rapidly to Alcock's action in centralising the joystick and rudder-bar. He opened up the throttles, and the Rolls-Royce engines came back to life in an instant. The danger was past. Once again disaster had been averted by the pilot's level-headedness and skill.

When, at last, the machine swung back to the level, and flew parallel with the Atlantic, our height was fifty feet. It appeared as if we could stretch downward and almost touch the great white-

Our Transatlantic Flight

caps that crested the surface. Before Alcock opened up the engines, we could actually hear the voice of the cheated ocean as its waves swelled, broke, and swelled again.

The compass needle, which had continued to swing, now stabilised itself, and quivered towards the west, showing that the end of the spin left us facing America. As we did not want to return to Newfoundland, and earnestly wanted to reach Ireland, Alcock turned the machine in a wide semi-circle and headed eastward, while climbing away from the ocean and toward the lowest clouds.

CHAPTER SIX

Morning

SUNRISE made itself known to us merely as a gradual lightening that showed nothing but clouds, above and below. The sun itself was nowhere visible.

We were flying in and out of dense patches of cloud; for every now and then we would pass through a great white mass, emerge into a small area of clearer atmosphere, and then meet another enormous barrier of nebulousness.

The indefiniteness of dawn disappointed my hopes of taking observations. Already at three o'clock I had scribbled a note to the pilot: 'Immediately you see sun rising, point machine straight towards it, and we will get compass bearings.' I had worked out a table of hours, angles, and azimuths of the sun at its rising, to serve as a check upon our position; but, as things happened, I was obliged to resume navigation by means of 'dead reckoning'.

A remark written in my log, at twenty minutes past four, was that the Vickers-Vimy had climbed to 6,500 feet, and was above the lower range of cloudbanks. For the rest, the three hours that followed sunrise I remember chiefly as a period of envelopment by clouds, and ever more clouds. Soon, as we continued to climb, the machine was travelling through a mist of uniform thickness that completely shut off from our range of vision everything outside a radius of a few yards from the wing-tips.

And then came a spell of bad weather, beginning with heavy rain, and continuing with snow. The downpour seemed to meet us almost horizontally, owing to the relative high speed of the Vickers-Vimy as compared with the rate of only a few feet per second at which the rain and snow fell.

The snow gave place to hail, mingled with sleet. The sheltered

Our Transatlantic Flight

position of the cockpit, and the streamlining of the machine, kept us free from the downfall so long as we remained seated; but if we exposed a hand or a face above the wind-screen's protection, it would meet scores of tingling stabs from the hailstones.

When we had reached a height of 8,800 feet, I discovered that the glass face of the petrol overflow gauge, which showed whether or not the supply of fuel for the engines was correct, had become obscured by clotted snow. To guard against carburettor trouble, it was essential that the pilot should be able to read the gauge at any moment. It was up to me, therefore, to clear away the snow from the glass.

The gauge was fixed on one of the centre-section struts. The only way to reach it was by climbing out of the cockpit and kneeling on top of the fuselage, while holding a strut for the maintenance of balance. This I did, and the change from the sheltered warmth of the cockpit to the biting, icy cold outside was startlingly unpleasant. The violent rush of air, which tended to push me backward, was another discomfort.

I had no difficulty, however, in reaching upward and rubbing the snow from the face of the gauge. Until the storm ended, a repetition of this performance, at fairly frequent intervals, continued to be necessary. There was, however, scarcely any danger in kneeling on the fuselage, as long as Alcock kept the machine level.

Every now and then we examined the engines, for on them depended whether the next four hours would bring success or failure. Meanwhile, we were still living for the moment; and, although I was intensely glad that four-fifths of the ocean had been crossed, I could afford to spare no time for speculation on what a safe arrival would mean to us. As yet, neither of us was aware of the least sign of tiredness, mental or physical.

When I had nothing more urgent on hand, I listened at the wireless receiver; but I heard no message for us from beginning to end of the flight. Any kind of communication with ship or shore would have been very welcome, as a reminder that we were not

Morning

altogether out of touch with the world below. The complete absence of such contact made it seem that nobody cared a darn about us.

The entry that I scribbled in my log at 6.20 a.m. was that we had reached a height of 9,400 feet, and were still in drifting cloud, which was sometimes so thick as to cut off from view parts of the Vickers-Vimy. Snow was still falling, and the top sides of the plane were covered completely by a crusting of frozen sleet.

The sleet imbedded itself in the hinges of the ailerons and jammed them, so that for about an hour the machine had scarcely any lateral control. Fortunately the Vickers-Vimy possesses plenty of inherent lateral stability; and, as the rudder controls were never clogged by sleet, we were able to hold to the right direction.

Alcock continued to climb steadily so as to rise above the seemingly interminable clouds, and let me have a clear sky for purposes of observation. At five o'clock, when we were in the levels round about 11,000 feet, I caught the sun for a moment—just a pin-point glimmer through a cloud-gap. There was no horizon; but I was able to obtain a reading with the help of my Abney spirit level. This observation gave us a position close to the Irish coast. Yet I could not be sure of just where we were on the line indicated by it. We therefore remained at 11,000 feet until, at 7.20 a.m., I had definitely fixed the position line. This accomplished, I scribbled the following message, and handed it across to the pilot:

‘We had better go lower down, where the air is warmer, and where we might pick up a steamer.’

Just as we had started to nose downward, the starboard engine began to pop ominously, as if it were backfiring through one of its carburettors. Alcock throttled back, while keeping the machine on a slow glide. The barking pops thereupon ceased.

By eight o'clock we had descended from 11,000 to 1,000 feet. Here, the machine was still surrounded by cloudy vapour; but the atmosphere was much warmer, and the ailerons were operating again.

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Alcock was feeling his way downward gently and alertly, not knowing whether the cloud extended to the ocean, nor at what moment the machine's undercarriage might touch the waves. He had loosened his safety belt, and was ready to abandon ship if we hit the water. I myself felt uncomfortable about the danger of sudden immersion, for it was very possible that a change in barometric conditions could have made the aneroid show a false reading.

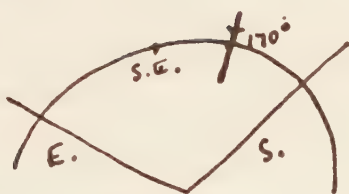
But once again we were lucky. At a height of 500 feet the Vickers-Vimy emerged from the pall of cloud, and we saw the ocean—a restless surface of dull grey. Alcock at once opened up the throttles, and both engines responded with a full-throated roar.

Evidently a short rest had been all that the starboard engine needed when it began to pop, for it now gave no further signs of trouble.

I reached for the drift bearing plate, and after observation on the ocean, found that we were moving on a course 75 degrees true, at 110 knots ground speed, with a wind of 30 knots from the direction of 215 degrees true. I had been reckoning on a course of 77 degrees true, with calculations based on our midnight position; so that evidently we were slightly to the north of the prescribed track. Still, we were not so far north as to miss Ireland; which fact was all that mattered to any extent.

In my correction of the compass bearing, I could only guess at the time when the wind had veered from its earlier direction. I made the assumption that the northerly drift had existed ever since my sighting on the Pole Star and Vega during the night, and I reckoned that our position at eight o'clock would consequently be about 54 degrees N. latitude, 10 degrees 30 min. W. longitude. Taking these figures, and with the help of the navigation machine, which rested on my knees, I calculated that our course to Galway was about 125 degrees true, allowing for variation and wind. I therefore set a compass course of 170 degrees, and indicated to the pilot the necessary change in direction by means of the following note and diagram:

'Make course



Don't be afraid of going S. We have had too much N. already.'

Alcock nodded, and gently ruddered the Vickers-Vimy around until its compass showed a reading of 170 degrees.

My calculations, if correct, proved that we were quite close to Ireland and journey's end. As we flew eastward, just below the lowest clouds and from 200 to 300 feet above the sea, we strained our eyes for a break in the monotonous vista of grey waves; but we could find not even a ship.

Although neither of us felt hungry, we decided to breakfast at eight o'clock, partly to kill time and partly to take our minds from the rising excitement induced by the hope that we might sight land at any instant. I placed a sandwich, followed by some chocolate, in Alcock's left hand. His right hand remained always on the joystick, and his feet on the rudder-bar.

At no time during the past sixteen hours had the pilot's hands and feet left the controls. This was a difficult achievement for such a long period, especially as a rubber device, fitted to ease the strain, had proved to be valueless. Elastic, linked to a turnbuckle, was attached to the joystick and rudder-bar; but in the hurry that preceded our departure from St. John's, a mechanic had cut it too short. All the weight of the controls, therefore, bore directly on the pilot.

The machine now tended to sag downward, being nose-heavy because its incidence had changed, owing to the gradual alteration in the centre of gravity as the rear petrol tanks emptied. Alcock was thus obliged to exert a continuous backward pressure on the joystick.

I had screwed on the lid of the thermos flask, and was placing

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the remains of the food in the tiny cupboard behind my seat, when Alcock grabbed my shoulder, twisted me round, beamed excitedly, and pointed ahead and below. His lips were moving, but whatever he said was inaudible above the roar of the engines.

I followed the direction indicated by his outstretched forefinger; and, barely visible through the mist, it showed me two tiny specks of—land. This happened at 8.15 a.m., on June 15.

With a light heart, I put away charts and tables of calculation, and disregarded the compass needle. My work as navigator of the flight was at an end.

CHAPTER SEVEN

The Arrival

ALCOCK flew straight for the specks of land, which revealed themselves as two tiny islands—Eeshal and Turbot, as we afterwards discovered. In his log of the return flight, from New York to Norfolk, of the British Airship R34, Brig.-Gen. Maitland, C.M.G., D.S.O., notes the curious coincidence that his first sight of land was when these same two islands appeared on the dirigible's starboard bow.

From above the islands the mainland was visible, and we steered for the nearest point on it. The machine was still just underneath the clouds, and flying at 250 feet; from which height I saw plainly the white breakers foaming on to the shore. We crossed the coast of Ireland at 8.25 a.m.

I was then uncertain of our exact location, and suggested to Alcock that the best plan would be to find a railway line and follow it south. A few minutes later, however, the wireless masts at Clifden gave the key to our position. To attract attention, I fired two red flares from the Verey pistol; but as they seemed to be unnoticed from the ground, we circled over the village of Clifden, about two miles from the wireless station.

Although slightly off our course when we reached the coast, we were in the direct line of flight for Galway, at which place I had calculated to hit Ireland. Not far ahead we could see a cluster of hills, with their tops lost in low-lying clouds.

Here and elsewhere the danger of running into high ground hidden from sight by the mist would have been great, had we continued to fly across Ireland. Alcock, therefore, decided to land.

Had the atmosphere been clearer, we should have found no difficulty in flying to London before we landed; for the tanks of

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the Vickers-Vimy still contained enough petrol to keep the machine in the air for ten hours longer. Thus, there would have been a useful margin of time for cruising about in search of ships, in case we had lost our way over the ocean.

Having made up our minds to land at once, we searched below for a smooth stretch of ground. The most likely-looking place in the neighbourhood of Clifden was a field near the wireless station. With engines shut off, we glided towards it, heading into the wind.

Alcock flattened out at exactly the right moment. The machine sank gently, the wheels touched earth, and began to run smoothly over the surface. Already I was indulging in the comforting reflection that the anxious flight had ended in a perfect landing. Then, so softly as not to be noticed at first, the front of the Vickers-Vimy tilted inexplicably, while the tail rose. Suddenly the craft stopped with an unpleasant squelch, tipped forward, shook itself, and remained poised on a slant, with its fore-end buried in the ground, as if trying to stand on its head.

I reached out a hand and arm just in time to save a nasty bump when the shock threw me forward. As it was, I only stopped a jarring collision with the help of my nose. Alcock had braced himself against the rudder control bar. The pressure he exerted against it, to save himself from falling, bent the straight bar, which was of hollow steel, almost into the shape of a horse-shoe.

Deceived by its smooth appearance, we had landed on top of a bog; which misfortune made the first non-stop transatlantic flight finish in a crash. It was pitiful to see the distorted shape of the machine that had brought us from America, as it sprawled in ungainly manner over the sucking surface. The machine's nose and its lower wings were deep in the bog. The empty cockpit in front, used in a Vickers-Vimy bomber by the observer, was badly bent; but, being of steel, it did not collapse. Quite possibly, we owe our lives to this fact. In passing, and while gripping firmly my wooden pen-holder, I consider it extraordinary that no lives have been lost in transatlantic flights.

The leading edge of the lower plane was bent in some places

The Arrival

and smashed in others, the petrol connections had snapped, and four of the propeller blades were buried in the ground, although none were broken. That about completed the record of preliminary damage.

We had landed at 8.40 a.m., after being in the air for 16 hours 28 minutes. The flight from coast to coast, on a straight course of 1,680 nautical miles, lasted only 15 hours, 57 minutes, our average speed being 105 to 106 knots. For this relatively rapid performance, a strong following wind was largely responsible.

As a result of the burst connections from tank to carburettor, petrol began to swill into the rear cockpit while we were still inside it. Very fortunately the liquid did not ignite. Alcock had taken care to switch off the current on the magnetos, as soon as he realised that a crash was imminent, so that sparks should have no chance of starting a fire.

We scrambled out as best we could, and lost no time in salving the mail-bag and our instruments. The petrol rose rapidly, and it was impossible to withdraw my chart and the Baker navigating machine before they had been damaged.

I then fired two white Verrey flares, as a signal for help. Almost immediately a small party of officers and men belonging to the military detachment at Clifden approached from the wireless station.

'Anybody hurt?'—the usual greeting when an aeroplane is crashed—was the first remark when they arrived within shouting distance.

'No.'

'Where you from?'—this when they had helped us to clear the cockpit.

'America.'

Somebody laughed politely, as if in answer to an attempt at facetiousness that did not amount to much, but that ought to be taken notice of, anyhow, for the sake of courtesy. Quite evidently nobody received the statement seriously at first. Even a mention of our names meant nothing to them, and they remained unconvinced

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until Alcock showed them the mail-bag from St. John's. Then they relieved their surprised feelings by cheers and painful hand-shakes, and led us to the officers' mess for congratulations and hospitality.

Burdened as we were with flying kit and heavy boots, the walk over the bog was a dragging discomfort. In addition, I suddenly discovered an intense sleepiness, and could easily have let myself lose consciousness while standing upright.

Arrived at the station, our first act was to send telegrams to the firm of Vickers, to the *Daily Mail*, and to the Royal Aero Club.

My memories of that day are dim and incomplete. I felt a keen sense of relief at being on land again, but this was coupled with a certain amount of dragging reaction from the tense mental concentration during the flight, so that my mind sagged. I was very sleepy, but not physically tired.

We lurched as we walked, owing to the stiffness that resulted from having sat in the tiny cockpit for seventeen hours. Alcock, who during the whole period had kept his feet on the rudder-bar and one hand on the control lever, would not confess to anything worse than a desire to stand up for the rest of his life—or at least until he could sit down painlessly.

My hands were very unsteady. My mind was quite clear on matters pertaining to the flight, but hazy on extraneous subjects. After having listened so long to the loud-voiced hum of the Rolls-Royce engines, made louder than ever by the broken exhaust pipe on the starboard side, we were very deaf, and our ears would not stop ringing.

Later in the day we motored to Galway with a representative of the *Daily Mail*. It was a strange but very welcome change to see solid objects flashing past us, instead of miles upon monotonous miles of drifting, cloudy vapour.

Several times during that drive I lost the thread of connection with tangible surroundings, and lived again in near retrospect the fantastic happenings of the day, night, and morning that had just passed. Subconsciously I still missed the rhythmic, relentless drone of the Rolls-Royce engines. My eyes had not yet become accus-

The Arrival

tomed to the absence of clouds around and below, and my mind felt somehow lost, now that it was no longer preoccupied with heavenly bodies, horizon, time, direction, charts, drift, tables of calculations, sextant, spirit level, compass, aneroid, altimeter, wireless receiver, and the unexpected.

For a while, in fact, the immediate past seemed more prominent than the immediate present. Lassitude of mind, coupled with the reaction from the long strain of tense and unbroken concentration on one supreme objective, made me lose my grip of normal continuity, so that I answered questions mechanically, and wanted to avoid the effort of talk. The outstanding events and impressions of the flight—for example, the long spin from 6,000 to 50 feet, and the sudden sight of the white-capped ocean at the end of it—passed and repassed across my consciousness. I do not know whether Alcock underwent the same mental processes, but he remained very silent. Above all, I felt the need of re-establishing normal balance by means of sleep.

The wayside gatherings seemed especially unreal—almost as if they had been scenes on the film. By some extraordinary method of news transmission the report of our arrival had spread all over the district, and in many districts between Clifden and Galway curious crowds had gathered. Near Galway we were stopped by another motor-car, in which was Major Mays of the Royal Aero Club, whose duty it was to examine the seals on the Vickers-Vimy, thus making sure that we had not landed in Ireland in a machine other than that in which we left Newfoundland.

A reception had been prepared at Galway, but our hosts, realising how tired we must be, considerably made it a short and informal affair. Afterwards we slept—for the first time in over forty hours.

CHAPTER EIGHT

Aftermath of Arrival

ALCOCK and I awoke to find ourselves in a wonderland of seeming unreality—the product of violent change from utter isolation during the long flight to unexpected contact with crowds of people interested in us.

To begin with, getting up in the morning, after a satisfactory sleep of nine hours, was strange. In our eastward flight of 2,000 miles we had overtaken time, in less than the period between one sunset and another, to the extent of three and a half hours. Our physical systems having accustomed themselves to habits regulated by the clocks of Newfoundland, we were reluctant to rise at 7 a.m., for subconsciousness suggested that it was but 3.30 a.m.

This difficulty of adjustment to the sudden change in time lasted for several days. Probably it will be experienced by all passengers travelling on the rapid trans-ocean air services of the future—those who complete a westward journey becoming early risers without effort, those who land after an eastward flight becoming unconsciously lazy in the mornings, until the jolting effect of the dislocation wears off, and habit has accustomed itself to the new conditions.

Then, after breakfast—eaten in an atmosphere of the deepest content—there began a succession of congratulatory ovations. For these we were totally unprepared; and with our relaxed minds, we could not easily adapt ourselves to the conditions attendant upon being magnets for a few days' curiosity from the world.

First came a reception from the town of Galway, involving many addresses and the presentation of a memento in the form of a Claddagh ring, which had historical connections with a thereabouts landing on the coast of Ireland by vessels of the Spanish

Aftermath of Arrival

Armada. The warm-hearted crowd that we found waiting at Galway station both amazed and daunted us. We were grateful for their loud appreciation, but scarcely able to respond to it adequately. Flowers were offered, and we met the vanguard of the autograph hunters. We must have signed our names hundreds of times during the journey to Dublin—on books, cards, old envelopes, and scraps of paper of every shape and every state of cleanliness. This we did wonderingly, not yet understanding why so many people should ask for our signatures, when three days earlier few people had heard of our names.

The men, women, and children that thronged every station on the way to Dublin seemed to place a far higher value on our success than we did ourselves. Until now, perhaps, we had been too self-centred to realise that other people might be particularly interested in a flight from America to England. We had finished the job we wanted to do, and could not comprehend why it should lead to fuss.

Now, however, I know that the crowds saw more clearly than I did, and that their cheers were not for us personally, but for what they regarded as a manifestation of the spirit of Adventure, the True Romance—call it what you will. For the moment this elusive ideal was suggested to them by the first non-stop journey by air across the Atlantic, which we had been fortunate enough to make.

At one station, where a military band played our train in and out again, a wooden model of an aeroplane was presented to Alcock by a schoolboy. At Dublin, reached on the morning of Trinity Sunday, Alcock and I passed with difficulty through the welcoming crowds, and drove towards the Automobile Club in separate cars. In due course, I reached sanctuary; but where was Alcock? We waited and waited, and finally sent out scouts to search for him. They came back with the news that he had been kidnapped, and taken to Commons in Trinity College.

Landing at Holyhead next morning, we were welcomed back to the shores of England by Mr. R. K. Pierson, designer of our Vickers-Vimy machine, by Captain Vickers, of the famous firm

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that built it, and by Mr. C. Johnson, of the Rolls-Royce Company, that supplied our engines. Scenes all along the line to London were a magnified repetition of those from Galway to Dublin. Chester, Crewe, Rugby, and other towns each sent its Mayor or another representative to the station. Aeroplanes escorted the train all the way to London. Again we could only play our part in a more or less dazed state of grateful wonder.

Of the warm-hearted welcome of the people of London, I have confused recollections that include more receptions, more and larger crowds, more stormy greetings, and an exciting, pleasant drive to the Royal Aero Club. Alcock delivered to the postal authorities the mail-bag from St. John's, with regrets that it had not been possible to fly direct to London with the letters. In the evening we separated, Alcock to see a big prize fight, I to visit my fiancée.

Perhaps the welcome that we appreciated most was that given us next day when, at the Weybridge works of the Vickers Company we were chaired and cheered by the men and girls who had built our transatlantic craft. We were glad indeed to be able to tell them and the designer of the machine that their handiwork had stood a difficult test magnificently. One of my most sincere reasons for satisfaction was that the late Mr. Albert Vickers, a founder of the great firm, regarded the flight as having maintained the Vickers tradition of efficiency, originality, and good workmanship.

That Lieut.-Commander Read, U.S.N., who commanded the American flying boat NC.4 in its flight from America to England, had left London before our arrival was a cause of real regret. Both Alcock and I were anxious to meet him and his crew, so that we might compare our respective experiences of aerial navigation and of weather conditions over the Atlantic. The United States aviators who flew to Europe, and those that were so unlucky in coming to grief at the Azores, showed themselves to be real sportsmen: and, without any exception, there was the best possible feeling between them and all the British aviators who made, or attempted to make, a non-stop journey from Newfoundland to Ireland.





'We got head to wind, and having climbed quickly to 1,000 feet, we set out on the eventful journey.'

Aftermath of Arrival

Although I am supremely glad to have had the opportunity of flying the Atlantic by aeroplane, afterthoughts on the risks and chances taken have convinced me that, while our own effort may have been useful as a pioneer demonstration, single or twin engine aircraft are altogether unsuitable for trans-ocean voyages. We were successful—yes. But a temporary failure of either of our engines (although this is unlikely when dealing with Rolls-Royce or other first-class aero engines) would have meant certain disaster and likely death. Another vital drawback of the smaller machines is that so much space, and so much disposable lift, is needed for fuel that the number of persons on board must be limited to two, or, in some cases, three, and no freight can be taken. Yet another is that should the navigator of an aeroplane make an important error in calculation while flying over the ocean in fog or mist, an enforced descent into the water, after the limited quantity of fuel has been expended over a wrong course, is more than possible.

In the present condition of practical aeronautics, the only heavier-than-air craft likely to be suitable for flying the Atlantic are large flying boats, and even they are limited as to size by certain definite formulae. The development in the near future of long flights over the ocean would seem, therefore, to be confined to lighter-than-air craft.

In this connection, the double voyage across the Atlantic of the British Government airship R34, not long after Alcock and I had returned to London, was a big step towards the age of regular air services between Britain and America. With five engines the R34 could carry on if one, or even two of them were out of action. In fact, on its return flight, one engine broke down beyond the possibility of immediate repair, although there were ample facilities and an ample crew for effecting immediate repairs in the air. Yet she completed her journey without difficulty. With a disposable lift of 29 tons, the airship carried plenty of fuel for all contingencies, an adequate crew, and heavy wireless apparatus that could not have been fitted on the larger aeroplanes.

Despite all this preliminary weight, a large collection of parcels,

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letters, and newspapers was taken from America to England in record time. Had the weather conditions been at all suitable she could easily have brought the mail direct from New York to London by air. All honour to Gen. Maitland, Major Scott, and the other men who carried out this astonishing demonstration so early as July, 1919.

Even vessels of the R34 type, however, are quite unsuitable for regular traffic across the Atlantic. Much bigger craft will be needed if the available space and the disposable lift are to be sufficient for the carrying of freight or passengers on a commercial basis. Already plans are being made for the construction of airships two and a half and five times the size of the R34, with approximate disposable lifts of 100 and 200 tons respectively. When these have materialised, and when further progress has been made in solving the two great problems of cheaper fuel and more economical, the air age may be at hand.

CHAPTER NINE

The Navigation of Aircraft

I DO not claim to be an authority on the theory of navigation; so that this chapter will not be of especial interest to experts. Indeed, it was as a prisoner of war that I first took up seriously the study of that science. But I believe that sustained and sufficient concentration can give a man most kinds of knowledge, and on this assumption I decided to learn whatever might be learned about aviation as applied to aircraft.

As yet, like most aspects of aeronautics, this is rather indefinite; although, probably, research and specially adapted instruments will make it as exact as marine navigation.

Navigation is the means whereby the mariner or aviator ascertains his position on the surface of the earth, and determines the exact position in which he must head his craft in order to reach its destination.

The methods of navigation employed by mariners are the result of centuries of research and invention, but have not yet reached finality—witness the introduction within the last few years of the gyroscopic compass and the directional wireless telegraph apparatus, as well as of improved methods of calculation.

In short journeys over land by aeroplane or airship the duties of a navigator are light, so long as he can see the ground and check his progress towards the objective by observation and a suitable map. But for long distance flights, especially over the ocean and under circumstances whereby the ground cannot be seen, the navigator of the air borrows much from the navigator of the sea. He makes modifications and additions, necessitated by the differences between keeping to a set course through the atmosphere and of keeping to a set course through the ocean; but the principles underlying the two forms of navigation are identical.

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It is impossible to explain aerial navigation without seeming to paraphrase other writers on the subject. One of the simplest explanations of the science is that of Lieut.-Commander K. Mackenzie Grieve in 'Our Atlantic Attempt', which he wrote in collaboration with Mr. Harry Hawker,* his pilot in a glorious attempt to win the *Daily Mail's* transatlantic competition.

The chief differences between the navigation of aircraft and the navigation of seacraft are occasioned by:

(a) The vastly greater speed of aircraft, necessitating more frequent observations and quicker methods of calculation.

(b) The serious drift caused by the wind. This may take aircraft anything up to forty or more miles off the course in each hour's flying, according to the direction and strength of the wind. In cloudy weather, or at night, a change in the wind can alter the drift without the knowledge of the navigator. Hence, special precautions must be taken to observe the drift at all possible times.

(c) The absence of need for extreme accuracy of navigation in the air, since a ten or even twenty mile error from the destination in a long journey is permissible. Another favourable point is that rocks, reefs, and shoals need not be avoided. This permits the aerial navigator to use short cuts and approximations in calculation, which would be criminal in marine navigation.

There are three methods of aerial navigation—'Dead Reckoning', Astronomical Observation, Directional Wireless Telegraphy. None should be used alone, for, although accuracy may be obtained with any single method, it is highly advisable to check each by means of the others.

As in the case of marine navigation, a reliable compass, either of the magnetic or gyroscopic type, is essential for aerial navigation, as well as an accurate and reliable chronometer. Suitable charts must be provided, showing all parts of the route to be covered. When the magnetic compass is used, such charts should show the variation between true and magnetic north at different points on the route.

* For Hawker's account of the attempt, see Part IV.

The Navigation of Aircraft

NAVIGATION BY 'DEAD RECKONING'

'Dead Reckoning' is the simplest method of navigation, and, under favourable conditions, it gives a high degree of accuracy. A minimum of observation is required, but careful calculation is essential.

The 'Dead Reckoning' position of an aeroplane or airship at any time is calculated from its known speed and direction over the surface of the earth or ocean, and its known course, as indicated by the magnetic or gyroscopic compass.

To determine the direction of movement of an aeroplane or airship, as apart from the direction in which it is headed, an instrument known as a drift indicator, or drift bearing plate, is used.

One form of drift indicator consists of a simple dial, with the centre cut away and a wire stretched diametrically across it. The outer edge of the dial is divided into degrees, in a similar manner to that of the compass. It is mounted in such a way that an observer, by looking through the centre of the disc, can see the ground or ocean below him. The disc is then turned until objects on the ground—or white-caps, icebergs, ships, or other objects visible on the surface of the ocean—are seen to move parallel with the wire, without in any way deviating from it. The angle which the wire then makes with the direction in which the nose of the aeroplane or airship is pointing gives the angle of drift.

The ground speed of aircraft can be measured by observing the time taken in passing over any fixed or very slowly moving object, while a certain angular distance is described—this being found by suitable sights, attached to the drift bearing plate. From the result, considered in conjunction with the height of the aeroplane or airship, the actual speed over the earth's surface is calculated. This speed will be in the direction shown by the wire of the drift bearing plate.

Having found by observation the drift, the ground speed, and the air speed, a simple instrument such as the Appleyard Course and Distance Calculator then permits the aerial navigator to discover without difficulty, as on a slide rule, the strength and direction of

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the wind. Should the actual track of aircraft over the earth's surface not coincide with the desired course, the course and distance calculator, or a similar instrument, can thus be used to calculate, in connection with the wind velocity and direction already found, the direction in which the nose of the craft must be pointed in order to correct the deviation due to drift.

Knowing the latitude and longitude of the point of departure, and noting carefully the time that elapses between each separate observation of the ground speed and of the course, the air navigator, with the aid of a specially prepared set of 'traverse tables' (as used by mariners) can easily plot on his chart the distance covered and the direction in which it has been covered. Hence the position of the aircraft at any time is either known definitely, or can be forecasted with a fair degree of accuracy.

For aerial navigation by means of 'dead reckoning', frequent observations of ground speed and drift are necessary. If aircraft are cut off by clouds or fog from all possibility of sighting the surface of the earth, grave errors may occur, since in long distance flights the wind's velocity and direction often change without the pilot's knowledge.

NAVIGATION BY ASTRONOMICAL OBSERVATION

In navigation by astronomical observation, the position of the aeroplane or airship is found by observing the height above the horizon of either the sun or another heavenly body, such as a star that is easy of recognition. The method depends upon the known fact that at any given instant the sun is vertically above some definite point on the earth's surface. This point can be calculated from the time of the observation and the declination and equation of time, as tabulated in the nautical almanac.

In the case of stars, the right ascension of the sun and of the star also enter into the calculation. The method of carrying out such calculations is too involved for the elementary scope of this chapter, and the reader is referred to the excellent text-books published on the subject of navigation.



The chart used by Arthur Whitten Brown during the flight

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Since the navigator knows, from the time of his observation, the point on the earth's surface over which is the heavenly body in question, it is clear that around this point circles on the surface of the earth may be described. From any point in any one circle the heavenly body will appear to have the same altitude or elevation above the horizon. A single observation of the altitude of a heavenly body shows, therefore, only that the observer may be at any point on such a circle of equal altitude—otherwise known as a Sumner circle. But it does not fix that point.

A second simultaneous observation, of a different heavenly body, will give a different circle, corresponding to the position of the second body. These two circles intersect at the exact point from which the observation is made.

This fact constitutes a reliable basis for fixing one's position during a clear night, when many stars are visible, and choice of suitable heavenly bodies may be made. During the day, however, the light of the sun prevents other heavenly bodies from being seen, so that only a single observation is possible.

If the aeroplane or airship were not moving, then two successive observations of the sun, with an interval of an hour or more between them, would give the intersecting circles and fix the position. But the aircraft being in motion, it is necessary to combine the method of 'dead reckoning' with the use of the Sumner circles, as found by observation of the sun's altitude.

In order to avoid drawing the entire circle, a small portion only of it is shown on the chart—so small that it may be regarded as a straight line. Such a small section of the Sumner circle is known as a 'position line'.

The desired track is laid out on the chart; and the 'dead reckoning' position for the time of the solar observation is indicated on it. The track should be intersected at this point by the position line, the observation line thus forming a check upon the 'dead reckoning'.

The altitude of the sun or of a star is measured by the sextant. For such an observation to be exact it is necessary that not only

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should the sun or stars be viewed clearly, but that a clear horizon, formed either by the ocean or by suitable clouds, should be visible.

Corrections must be applied to the observed altitude for the aircraft's height above the horizon, for refraction, and for the diameter of the body under observation—the last two corrections being given in the nautical almanac. There may be, also, an error inherent in the sextant itself. For extremely refined navigation, corrections are applied in accordance with the direction and velocity of the aeroplane or airship; but these are not really necessary, since navigation of aircraft does not require such close calculation.

When the sun or star observed is directly south of the aerial navigator in the northern hemisphere, or north of him in the southern hemisphere, the altitude, corrected for declination of the body under observation, gives the aircraft's latitude. When the navigator is directly east or west, the altitude, corrected for the time of observation, gives its longitude.

If the horizon is invisible, owing to fogs or unsuitable clouds, it may be replaced by means of a spirit level; but great care should be taken in making such observations, since a spirit level on an aeroplane or airship is not wholly reliable, unless the craft is proceeding in an absolutely straight direction, and without sway of any kind.

All methods of navigation by astronomical observation fail when the sky is obscured by clouds and the heavenly bodies cannot be seen. As a general rule, this drawback does not hamper air navigators to any great extent, since aircraft should be able to climb above most of the obscuring clouds. Yet it may happen, as it did in the case of our transatlantic flight, that the clouds are too high for such a manoeuvre.

If it were possible to measure accurately the true bearing of the sun or star at the moment of observation, then a single observation of a single heavenly body would fix the position of the craft at the intersection of the line of bearing with the position line. At the time of writing, however, there are no satisfactory means of

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making such a measurement with the required degree of accuracy. Apparatus which will enable this to be done is now in course of development. Navigation by means of astronomical observation will thereby be simplified greatly.

NAVIGATION BY WIRELESS DIRECTION FINDER

With the great improvements that have been made in the year 1919, the guiding of aircraft by directional wireless telegraphy is rapidly becoming a reliable and accurate means of aerial navigation. Although complicated in design and construction, the complete receiving equipment for aircraft is now light, compact, and simple of operation.

The receiving equipment on aeroplanes and airships is arranged so as to indicate, with a comparatively high degree of accuracy, the direction from which wireless signals are received. The position of the sending, or beacon, station being known, the bearing of the aircraft from that station may be plotted on a suitable chart, in which small segments of great circles are represented by straight lines. Simultaneous bearings on two known beacon stations are sufficient to fix the observer's position with tolerable accuracy at the intersection of the lines of bearing, provided that they intersect at a reasonable angle—45 degrees or more, where possible.

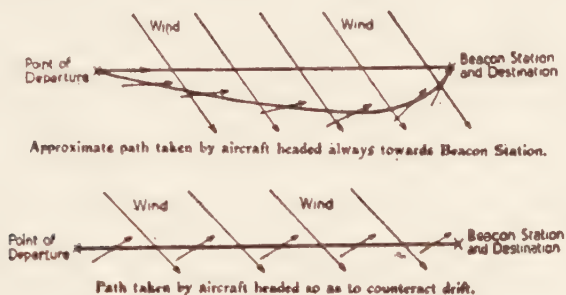
With the very close tuning rendered possible by the use of continuous waves, it is probable that beacon stations of the future will be provided with automatic means whereby directional signals can be sent out at intervals of one hour or less. Such signals will be coded, so that the crews of aircraft can identify the wireless station. The wave lengths must be chosen so as not to interfere with messages sent from commercial stations.

If there be a beacon station at the air navigator's destination, it is possible for him to direct his course so that the craft is always headed for the beacon, and in due time he will reach his objective.

This simple, but lazy method, however, is not to be recommended; for, owing to the action of the wind, the route covered is longer than the straight course. To counteract drift, and proceed

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in a direct line towards his destination, the air navigator frequently has to direct his course so that the craft is not headed straight for the objective. Hence, with a single beacon station, frequent observations of drift are necessary, if the shortest route is to be followed. Thus:



When two or more beacon stations are available, and positions can be ascertained at least once an hour, observation on the surface of the ocean for drift, although desirable, is not absolutely necessary. The drift may be calculated with accuracy enough from the craft's position, as found by the lines of bearing indicated in messages from the various beacon stations.

Another method of employing the wireless direction finder is for aircraft to send out signals to two or more beacon stations, which reply by advising the air navigator of his bearing in relation to themselves. This is, perhaps, the most accurate method. Its disadvantage lies in the fact that whereas the heavier and more robust apparatus needed for it can be employed in the stationary beacon stations, few aircraft will be able to support wireless sending apparatus of sufficient weight to carry over the long distances they must cover in trans-oceanic aerial travel.

The greatest advantage of air navigation by wireless telegraphy is that it can be employed in any weather. Fogs and clouds do not make it inoperative, nor even less accurate. Another recommendation is that its use does not entail a knowledge of advanced mathematics, as required for navigation by astronomical observation.

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I believe firmly that the air navigator of the future will rely upon the wireless direction finder as his mainstay, while using astronomical observation and the system of 'dead reckoning' as checks upon the wireless bearings given him, and as second and third strings to his bow, in case the wireless receiving apparatus breaks down.

CHAPTER TEN

The Future of Transatlantic Flight

ALTHOUGH three pioneer flights were made across the Atlantic during the summer of 1919, since then a year has passed without bringing to light any immediate prospect of an air service between Europe and America. Nor does 1921 seem likely to produce such a development.

Before a transatlantic airway is possible, very much must be provided—organisation, capitalisation, Government support, the charting of air currents, the establishment of directional wireless stations, research after improvements in the available material. All this requires the spending of money; and for the moment neither Governments nor private interests are enamoured of investments with a large element of speculation.

But, sooner or later, a London–New York service of aircraft is certain to be established. Its advantages are too tremendous to be ignored for long. Prediction is ever dangerous, and, meantime, I am confining myself to a discussion of what can be done with the means and knowledge already at the disposal of experts, provided their brains are allied to sufficient capital.

Notwithstanding that the first two flights across the Atlantic were made respectively by a flying boat and an aeroplane, it is evident that the future of transatlantic flight belongs to the airship. If science discovers some startlingly new motive power—for example, inter-molecular energy—that will revolutionise mechanical propulsion, heavier-than-air craft may be as valuable for long flights as for air traffic over shorter distances. Until then, trans-ocean flying on a commercial basis must be monopolised by lighter-than-air craft.

The aeroplane—and in this general term I include the flying

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boat and the seaplane—is impracticable as a means of non-stop transport for distances over 1,000 miles, because it has definite and scientific limitations of size, and consequently of lift. The ratio of weight to power would prevent a 40-ton aeroplane—which is approximately the largest heavier-than-air craft that at present might be constructed and effectively handled—from remaining aloft in still air for longer than 25 hours, carrying a load of passengers and mails of about five tons at an air speed of, say, 85 miles an hour. Its maximum air distance, without landing to replenish the fuel supply, would thus be 2,125 miles. For a flight of 2,500 miles all the disposable lift (gross lift minus weight of structure) would be needed for crew and fuel, and neither passengers nor freight could be taken aboard.

There is not in existence an aeroplane capable of flying, without alighting on the way, the 3,000 miles between London and New York, even when loaded only with the necessary crew. With the very smallest margin of safety no transatlantic route of over 2,000 miles is admissible for aeroplanes. This limitation would necessitate time-losing and wearisome journeys between London and Ireland, Newfoundland and New York, to and from the nearest points on either side of the ocean. Under such conditions, only important mail or valuable articles of little weight might be carried profitably.

As against these drawbacks, the larger types of airship have a radius far wider than the Atlantic. Their only limit of size is concerned with landing grounds and sheds; for the percentage of useful lift increases with the bulk of the vessel, while the weight to power ratio decreases. A voyage by dirigible can be made directly from London to New York, and far beyond it, without a halt.

Another advantage of lighter-than-air craft is that whereas the restricted space on board an aeroplane leaves little for comfort and convenience, a large airship can easily provide first-rate living, sleeping, and dining quarters, besides room for the passengers to take exercise by walking along the length of the inside keel, or on a shelter deck. In a saloon at the top of the vessel no noise from the

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engines would be heard, as must be the case in whatever quarters could be provided on a passenger aeroplane.

Yet another point in favour of the airship as a medium for trans-ocean flight is its greater safety. Most aeroplanes are entirely dependent for sustentation in the air on the proper working of all their engines. Should any engine break down, the result is likely to be a forced descent into the water, with the possibility of total loss on a rough sea, even though the craft be a solid flying boat. In the case of an airship the only result of the failure of any of the engines is reduction of speed. Moreover, a speed of four-fifths of the maximum can often be maintained with half the engines of an airship out of action, so that there is no possibility of a forced descent owing to mechanical breakdown. The sole result of such a mishap would be to delay the vessel's arrival. Further, it may be noted that an airship's machinery can be so arranged as readily to be accessible for repairs and replacement while on a voyage.

As regards comparative speed, the heavy type of aeroplane necessary to carry an economical load for long distances would not be capable of much more than 85 to 90 miles an hour. The difference between this and the present airship speed of 60 miles an hour would be reduced by the fact that an aeroplane must land at intermediate stations for fuel replenishment. Any slight advantage in speed that such heavier-than-air craft may possess will disappear with the production of larger types of dirigible, capable of cruising speeds varying from 75 to 90 miles an hour.

For the airship service London-New York direct, the approximate time under normal conditions should be 50 hours. For an aeroplane service London-Ireland-Newfoundland-New York the time would be at least 46 hours.

Perhaps the most convincing argument in favour of airships as against aeroplanes for trans-ocean aviation is that of comparative cost. All air estimates, under the present conditions, must be very approximate: and I make no claim to reliability for the figures here given. They are prepared by a Vickers expert, and differ in rather important details from those given by Brig.-Gen. Maitland in a

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brilliant lecture. My figures go to show that, with the equipment likely to be available during the next few years, a regular and effective air service between London and New York would need (again emphasising the factor of approximation) the following capital and rates:

	* Airship Service.	† Aeroplane Service.
Capital required	£2,600,000	£3,860,000
Passenger rate:		
London-New York	£48	£115
Rate per passenger mile	4d.	9d.
Mails per ounce:		
London-New York	3d.	7½d.

* For airship with gross gas capacity of 3,500,000 cubic feet and total load of 105 tons.

† For machine with total load of 40 tons.

These figures for an airship service are based on detailed calculations, of which the more important are:

Capital charges:

Four airships of 3,500,000 cub. ft. capacity, at £400,000 each	£1,600,000
Two double airship sheds, at £300,000 each	600,000
Land for two sheds and aerodromes, at £30,000 each	60,000
Workshops, gas plants, and equipment	150,000
Working capital, including spare parts, stores, etc.	170,000
Wireless equipment	10,000
Miscellaneous accessories	10,000
Total capital required	£2,600,000
Annual charge, interest at 10 per cent	£260,000

Depreciation and insurance:

Airships. Useful life, about 3 years.
 Obsolete value, about £20,000 per ship.
 Total depreciation per ship, £380,000 in 3 years.
 Average total depreciation per annum for four ships for three years, £507,000.





A contented breakfast at Clifden Wireless Station.

‘The machine’s nose and its lower wings were deep in the bog.’



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Airship Sheds.

Total annual charge, £18,000.

Workshops and plant.

Depreciation at 5 per cent per annum, £3,500.

Total annual charge for depreciation	£530,000
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Total annual insurance charges	£123,500
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Annual establishment expenses:

Salaries of officers and crews:

4 Airship commanders	£4,000
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8 Airship officers	6,000
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Total number crew hands (54)	16,000 £26,000
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Salaries of establishment:

Management and staff	£5,000
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Workshop hands, store-keepers, etc. (50 at each shed—total 100)	20,000 £25,000
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Total annual establishment expenses	£51,000
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Repairs and maintenance:

Sheds and plant, annual charge about	£5,000
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Repairs and overhaul of airships	20,000
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Total charge	£25,000
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Total annual charges on above basis	£989,500
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Say	£1,000,000
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Cost chargeable per crossing:

Taking the total number of crossings per year as 200

(London-New York):

Proportion of annual charges per crossing	£5,000
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Petrol per trip, 30 tons at £25 per ton	750
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Oil per trip, 2 tons at £40 per ton	80
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Hydrogen used, 750,000 cub. ft. at 10s. per 1,000 cub. ft.	375
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Cost of food per trip for crew of 19 and 100 passengers	400
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Total charge per crossing (London-New York)	£6,605
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The weight available for passengers and mails on each airship of the type projected would be 15 tons. This permits the carrying

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of 140 passengers and effects, or of 10 tons of mails and 50 passengers. To cover the working costs and interest, passengers would have to be charged £48 per head and mails £425 per ton for the voyage London–New York.

This charge for passengers is already much less than that for the more expensive berths on transatlantic liners. Without a doubt, with the coming of cheaper fuel, lower insurance rates, and larger airships, it will be reduced eventually to the cheapest rate for first-class passages on sea liners.

With a fleet of four airships, a service of two trips each way per week is possible. For aeroplanes with a total load of 40 tons the weight available for passengers and mails is 2.1 tons. If such a craft were to carry the same weekly load as the service of airships—30 tons each way—it would be necessary to maintain 14 machines continually in commission. Allowing for 100 per cent. spare craft as stand-by for repairs and overhaul, 28 aeroplanes would be required. The approximate cost of such a service is:

Capital charges:

28 aeroplanes at £120,000 each	£3,350,000
28 aeroplane sheds at £10,000 each	280,000
Land for 4 aerodromes	100,000
Workshops and equipments	20,000
Spare parts, etc.	100,000
Wireless equipment	10,000
Total capital required	£3,860,000
Annual charge at 10 per cent interest	£386,000

Depreciation and insurance:

Aeroplanes. Useful life, about 3 years, as for airships.

Obsolete value, about £6,000 per machine.

Average total depreciation per annum for 28 machines,
£1,050,000.

Aeroplane Sheds. Total annual charge, £12,000.

Workshops and plant. Depreciation at 3 per cent per annum, £600.

Total annual charge for depreciation £1,062,800

Total annual insurance charges 230,000

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Annual establishment expenses:

Salaries of 36 pilots at £600 per annum . . .	£21,600
Salaries of 36 engineers at £400 per annum . . .	14,400
Salaries of 12 stewards at £300 per annum . . .	3,600
Salaries of establishment:	
Management and staff	5,000
Workshop hands and store-keepers, etc., 100 off. .	20,000
Total annual establishment expenses	£64,600

Repairs and maintenance:

Sheds and plants, annual charge, say	£5,000
Repairs and overhaul to machines	10,000
Total	£15,000
Total annual charges on above basis	£1,758,500

Cost chargeable per crossing:

Proportion of annual charges per crossing	£1,450
Petrol used per trip, 28 tons at £25 per ton	700
Oil per trip, 2 tons at £40 per ton	80
Cost of food per trip for 29 passengers and crew of seven	100
	£2,330

It will be seen from the above that the direct running cost is 38 per cent, and the overhead charges 62 per cent of the total cost.

With a weight of 2.1 tons available on each machine for passengers and mails, passengers would be charged about £115 per head, and mails £1,150 per ton to cover the working costs and interest.

Having made clear that for many years to come the airship is the only means of transatlantic flight on a paying basis, the next point to be considered is the type of dirigible necessary. A discussion at present of the size of the airships that will link Europe and America can be little more substantial than guess-work.

The British dirigible R.34, which last year made the famous pioneer voyage between England and the United States, is too

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small for commercial purposes, with its disposable lift of 29 tons and its gas capacity of less than 2,000,000 cubic feet.

There have been predictions regarding airships of 5,000,000 and 10,000,000 cubic feet capacity, with respective weights of 30 tons and 100 tons available for passengers and freight. It is probable, however, that such colossi must await birth for many years, and that a beginning will be made with moderate-sized craft of about 3,500,000 cubic feet capacity, similar to those that serve as the basis of the estimates already given, for a service between London and New York. They can be built immediately, and there are already in existence suitable sheds to house them. Details of their structure and capabilities may be of interest.

The projected airship of 3,500,000 cubic feet capacity is capable of carrying a useful load of 15 tons (passengers and mails), for a distance of 4,800 miles in 80 hours, at the normal cruising speed. The total lifting power is 105 tons, and the disposable lift (available for fuel, oil, stores, crew, passengers, and freight) is 68 tons. The maximum engine power is 3,500 h.p., the maximum speed 75 miles an hour. The normal flying speed, using a cruising power of 2,000 h.p., is 60 miles an hour. The overall length is 800 feet, the maximum diameter and width 100 feet, and the overall height 105 feet. These particulars and performances are based on present design, and on the results attained with ships of 2,000,000 cubic feet capacity, now in service. The figures are conservative, and it is probable that a disposable lift greater than that of the specifications will be obtained, as a result of improved structural efficiency.

The passenger accommodation will be such that the air journey can be made in comfort equal to that on a first-class liner of the sea. Apart from their comparatively small disposable lift, a main objection to vessels of the R34 type for commercial purposes is that the living quarters are in cars slung from under the middle envelope. In this position they are necessarily rather cramped. In the proposed craft of 3,500,000 cubic feet capacity the passengers' quarters are at the top of the vessel. There, they will be roomy and entirely free from the noise and vibration of the engines. They can be

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reached through an internal corridor throughout the length of the ship, or by a lift from the bottom of it.

The main saloon is a large saloon lounge fitted with tables and chairs in the style of a Pullman car. Around it are windows, allowing for daylight and for an outlook in every direction. Part of it is fireproofed, and serves as a smoking-room.

Next to, and communicating with, the lounge is the dining-saloon. This leads to a serving hatch and to electrical cooking apparatus. Electrical power is provided by dynamos driven off the main engines. Current for electric lighting and heating of the saloon, cars, and sleeping quarters is provided by the same method.

Sleeping accommodation is in four-berth and two-berth cabins on top of the airship and forward of the living saloons. The cabins are of the type and size fitted on ocean-going steamers. With them are the usual bathrooms and offices. Other conveniences are an open shelter deck aft, to enable passengers to take the air, and an observation car, fitted below the hull and also at the aft end, so that they can observe the land or sea directly below them.

No danger from fire need be feared. The machinery installation is carefully insulated from the gasbags, and the quarters are to be rendered fire-proof and gas-proof. Moreover, the amount of weight involved by the passengers' section is so small, compared with the weight of the machinery, fuel, cargo, and stores, carried in the lower part of the craft, that the stability of the ship for rolling is unaffected by the novel position of the living quarters.

The ship's officers should have on the hull, towards the forward end, a control and navigation compartment, containing the main controls, besides navigation instruments, charts, and a cabin for the wireless telegraphy installation. The windows of this car give a clear view in every direction.

Other general specifications are:

Hull Structure. The shape of the hull is of the most perfect streamline form within the limitations of constructional requirements. An internal keel corridor, running along the bottom of the hull, contains all petrol and oil tanks, and the water ballast.

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Outer Covering. The outer cover is made of special weather-proof fabric, which gives the longest possible life. This fabric is as efficient as possible in insulating the gas from change of temperature, and thus avoids great variations in the lift.

Gasbags. The gas capacity is divided up into gasbags made of suitable rubber-proofed cotton fabric, lined with gold-beater skins. Gasbags will be fitted with automatic relief valves and hand control manoeuvring valves.

Machinery Cars. Six machinery cars are provided, each containing one engine installation, with a direct-driven propeller fitted at the aft end. These compartments give the mechanics easy access to each of the six engines, and allow them to handle all parts of the machinery. Engine room telegraphs of the electrical type communicate between the forward compartment and each of the machinery cars.

Whereas the living quarters and the control compartment must be heated by electrical radiators, arrangements can be made to warm the machinery cars by utilising the exhaust heat. The transmission gear in two of the wing cars is to be fitted with reversing gear; and the craft, therefore, may be driven astern. So that passengers shall not be worried by the usual roar of the exhaust, special silencers are to be fitted. The transmission gear is also so arranged that all unnecessary clamour from it may be avoided.

The engines run on petrol, but they have devices whereby they can be run alternatively on hydrogen. They are designed to develop their maximum power at a height of 5,000 feet.

Inflated buffer landing bags of a special type are to be fitted underneath the forward control compartment, and underneath the two aft machinery cars. These enable the airship to alight on either land or sea.

A powerful wireless telegraphy installation is to be fitted in the wireless cabin in the forward control compartment. It should have a range for sending and receiving of at least 5,000 miles.

As regards crew, two watches would be required, taking duty in eight-hour shifts. Both must be on duty when the craft leaves

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or lands. Each watch consists of navigating officer, steersman, lift operator, four engineers, and a wireless operator. With the commanding officer and two stewards, whose duties are not regulated by watches, the crew thus numbers 19 men.

Although the speed of the airship at maximum power is 75 miles per hour, the crossing normally would be at 60 miles per hour, which only requires 2,000 horse power, and is thus much more economical in fuel. The full speed, however, can be used whenever the ship is obliged to voyage through storm areas or against strong head winds. By the Azores route the time needed for the journey of 3,600 miles, at a speed of 60 miles an hour, is 60 hours; but to prepare for delays owing to adverse weather, the airship would always carry 80 hours' fuel, allowing for a speed of 50 miles an hour. The normal time for the journey, London to New York, via Portugal and the Azores (3,600 miles) would be, therefore, $2\frac{1}{2}$ days. The normal time for the journey, New York to London, by the direct route (3,000 miles) would be just over 2 days.

The prevailing wind on the direct route is almost always from west to east, which is unfavourable to the westbound journey. It is proposed that the crossing eastward from New York to London be made by the most direct route, advantage thus being taken of the westerly winds.

By making the westbound journey on the southerly route via the coast of Portugal and the Azores, and on 35 deg. N parallel of latitude across the Atlantic, and then to New York, the voyage is made in a region where the prevailing westerly winds of the higher latitudes are absent, and only light winds are encountered, generally of a favourable direction. This route, however, adds about 600 miles to the distance. With a ship speed of 60 miles per hour, it would be quicker to make the westbound journey by the direct route if the westerly wind did not exceed 10 miles per hour. If the wind were greater, time would be saved by covering the extra 600 miles of the southerly route and dodging the unfavourable air currents.

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With four airships on the cross Atlantic airway two only would be in service at a time, so that each could lay up during alternate weeks for overhaul and re-fit. As the time of journey between London and New York will vary between 50 to 60 hours, each airship can easily make two crossings, or one double journey, per week; thus giving a service, with two dirigibles, of two 'sailings' each way per week.

The average time-table might be as follows:

Leave London.	Arrive New York.
Monday morning.	Wednesday afternoon or evening.
Thursday morning.	Saturday afternoon or evening.
Leave New York.	Arrive London.
Monday afternoon.	Thursday morning.
Thursday afternoon.	Sunday morning.

From available weather reports, it is considered that crossings are practicable on at least 300 days in the year. Probably, a total of 200 crossings in the year could be maintained. Until further study of weather conditions supplies a certain knowledge of the best possible altitudes and latitudes, it is likely that a regular service of two crossings each way per week can be expected only in the months of May to September, and that the crossings from October to April will be irregular, the day of departure being dependent upon the weather.

Weather difficulties are likely to be much less severe than might be imagined. Rain, hail, and snow should have little influence on the navigation of airships. An outer covering that is rainproof and non-absorbent avoids the absorption of water, and the consequent increase of weight. Hail and snow cannot adhere to the surface of the craft when in flight, owing to its high speed through the air; and, in any case, the precipitation height being not more than 8,000 feet, they may be avoided by flying above this altitude.

Fog gives trouble in landing, but during the journey an airship can keep above it. If the terminal were enveloped by fog, an arriving ship could pass on to an emergency landing ground away from the fog belt; if the mistiness were slight, it could remain in the air

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until the ground were visible, making use of its margin of fuel beyond the amount necessary for the London-New York flight. Airships in fog may be enabled to find their landing-place by means of captive balloons or kites, and of strong searchlights from the ground. At night, the balloons or kites could carry electric lights, with connections from the aerodrome.

In any case, fog, rain, hail, and snow are nearly always local in their occurrence, and a navigator could avoid them by a short deviation from the usual route. Atlantic records indicate that on the main steamship routes, fog sufficient to impede navigation does not occur on more than about twelve days in the year.

Wind is a factor that needs more careful study in its relation to transatlantic air navigation. In most cases, unduly strong winds can be dodged by flying on a higher level, or by cruising on a different course, so as to avoid the storm belt. Heavy storms, which are usually of a cyclonic nature, rarely cover an area of more than 200 miles diameter. Moreover, the rate of progression of a cyclonic area is much less than the speed of the air movement. An airship is able to shake off a cyclonic area by a deviation from its course of not more than 200 miles. Once away from the storm belt, it seldom has difficulty in keeping clear of it.

When higher levels of the air have been charted, there is every reason to believe that the known movements of the Atlantic winds will be used to shorten air journeys. There are at sea level, between certain clearly defined latitudes, prevailing winds of constant direction. At greater heights, also, there is in most latitudes a constant drift which, if it were charted, might be useful even if the winds at sea level were unfavourable.

Although precise information is available of the prevailing and periodic winds at sea level in various latitudes, very little co-ordinated work appears to have been done in charting the prevailing and seasonal winds in higher levels of the atmosphere. Observations of the air currents over various localities in the United States, England, and Germany have been taken, but very little is known of the winds above the great ocean tracts. There is a great necessity

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for international research to provide data for predictions of weather conditions in the upper atmosphere, and so enable advantage to be taken of these higher currents.

At high altitudes, constant winds of from 30 to 40 miles per hour are common. If the prevailing directions of those were known to airship navigators, the duration of the journey could be considerably shortened, even though this meant taking an indirect route. It is undesirable to fly at great heights owing to the low temperature; but with suitable provision for heating there is no reason why flying at 10,000 feet should not be common.

Air currents cannot be charted as exactly as sea currents, but much valuable work can and will be done by tabulating in detail, for the guidance of air navigators, the tendencies of the Atlantic atmospheric drifts. Reliable charts, used in conjunction with directional messages from wireless stations and ships, may make it possible for vessels on the London-New York air service always to avoid troublesome winds, as well as storms and fogs, and to reduce the percentage of risk to a figure not exceeding that relative to sea liners.

For the rest, the excellence of the most modern engines, and the fact that one or two, or even three of them, may be temporarily out of action without affecting the airship's stability during a flight, minimise the danger of a breakdown from loss of power. The only remaining obstacle to reasonable safety would seem to be in landing on and departing from the terminal during rough weather. This can be overcome by the recently patented Vickers mooring gear for rigid airships.

The gear, designed so as to permit an airship to land and remain moored in the open for extended periods in any weather, without the use of sheds, consists principally of a tall steel mast or tower about 150 feet in height, with a revolving head to which the craft is rigidly attached by the nose, permitting it to ride clear of the ground and to turn round in accordance with the direction of the wind. It is provided with a hauling-in winch and rope to bring the ship up to the mooring point.

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A lift, for passengers and goods, runs up the tower from the ground to the platform adjoining the nose of the airship. The passengers reach their quarters along a corridor through the vessel and the goods are taken down a runway. An airship moored to this mast can remain unharmed in even the worst weather, and need be taken into a shed only when overhaul and repairs are necessary.

It may be that the London–New York air service will not arrive for many years. Sooner or later, however, it must arrive; for science, allied to human enterprise, never neglects a big idea. It may be that, when it does arrive, the structure of the craft and the methods of navigation applied to them will differ in important details from what I have indicated. I make no pretence at prophecy, but have merely tried to show how, with the means already to hand, moderately-priced air journeys from Europe to America might be made with comfort, safety, and a high degree of reliability. Meanwhile, much depends on the funds available for the erection of stations for directional wireless, on research into the air currents at various levels above the Atlantic Ocean, on the courage of capitalists in promoting what seems to be a very speculative enterprise, and on new adaptations of old inventions.

CHAPTER ELEVEN

The Air Age

ALTHOUGH facts disappointed over-sanguine expectations that the billions of pounds invested in aeronautics during the war would pay dividends already in 1919, the year brought us noticeably nearer the age of general flight. Meantime, commercial aviation is still a long way from the stage at which bankers regard its undertakings as good security for loans.

Air routes of sorts were opened up in most parts of the world in 1919. Capt. Ross-Smith proved by his magnificent journey from England to Australia in a Vickers-Vimy aeroplane, that long-distance flights over the most out-of-the-way lands and ocean tracks could be made even before terminals, landing-grounds, and wireless stations were provided for air pilots and navigators. The Atlantic was crossed four times, twice by a dirigible, once by an aeroplane, and once by a flying boat. Aeroplanes were flown from England to India. Aircraft were used for commercial purposes in every part of Western Europe, in most countries of North and South America, in Australia, India, Egypt, and South Africa. Important exhibitions of modern aircraft, similar to the motor shows, were held in London, New York, Paris, Amsterdam, and elsewhere.

As a result of this activity, all the Powers can show commercial air services in full operation. Of these the most important are perhaps the triangular airways around London, Paris, and Brussels. The London-Paris services have established a fine record for efficiency and regularity, if not as dividend-earners. Valuable and urgent freight of every kind has been delivered in safety. Assorted London newspapers have been taken each morning to Paris, and sold in the streets on the day of publication, instead of next morn-

ing, as was the case when they were forwarded by train and packet-boat. Leading papers, such as the *Times*, the *Telegraph*, the *Morning Post*, the *Daily Mail*, and the *Daily Express* placed regular contracts with one of the aerial transport companies.

As for passengers, men of every occupation take advantage of the opportunity to travel comfortably from London to Paris in 2½ hours. There is seldom a vacant seat on the larger machines, although the fare is still rather high. Moreover, the accommodation on two new types of aeroplane for the London-Paris airway—the Handley-Page W8 and the Airco D.H.18—is more attractive than that of a Pullman car.

The past year saw no specially important developments of commercial aviation inside Great Britain itself. A week-end service between Southampton and Havre was inaugurated, and passengers and mails were flown from London to Leeds. The most important undertaking was perhaps the delivery by air of newspapers. For a time the Manchester edition of the *Daily Mail* was taken by air for distribution in Carlisle, Dundee, and Aberdeen, the last-named place being reached in 3¼ hours instead of the 13 hours of train journey. Evening newspapers were carried daily during the summer from London to various resorts on the South Coast.

Otherwise, the air rates proved to be too high for general convenience. Although there were plenty of available aerodromes, the promoters of aerial transport companies could not compete with the all-embracing network of railways. For the rest, aeroplanes in England have been chartered sometimes as aerial taxicabs for special trips, and one or two companies have reaped a moderate harvest by organising pleasure trips at the summer resorts. A few wealthy amateurs have bought aeroplanes for their private use.

Other European countries—France, Italy, Holland, Belgium, Scandinavia, Spain, and Portugal—have made rather less progress in the manufacture and development of aeroplanes or dirigibles. Their use of aircraft for commercial purposes is about the same as that of Britain—newspaper distribution, some special journeys, and many joy-rides. French aviators have opened tentative airways to

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Morocco, Senegal, and Tunis. For regular passenger or goods services in continental Europe the high cost of fuel and accessories mostly makes the rates too high. Also, aerodromes and landing grounds are too few, and seldom can aeroplanes compete on a large scale with railways over comparatively short distances.

Germany, throughout what was for her a terrible year, made further progress with her dirigibles. A number of return voyages were made over the route Berlin-Munich-Vienna-Constantinople. The new type of Zeppelin—the *Bodensee*—is so efficient that no weather conditions, except a strong cross-hangar wind, prevents it from making its daily flight of 390 miles between Friedrichshafen and Staalsen, thirteen miles from Berlin. The passenger-carrying Zeppelins, which prior to the war provided the only important use of commercial aircraft, claim a remarkable record. They have carried more than 140,000 people, and yet not one of the passengers has been killed or injured in an accident, although some members of the crews lost their lives in the early days of the pioneer Zeppelins.

The vast distances of the United States offer better opportunities for aeroplane traffic than the comparatively small and closely-railwayed countries of Western Europe. There is no doubt that, had the U.S. Government given its aircraft companies even the small amount of support accorded by the British Government, commercial aviation in America would have travelled along a smooth road. Deprived of such support it has made fair progress. Successful regular services are established between Los Angeles and San Diego and elsewhere in the West, and in the East many passengers have been carried between New York and Atlantic City, and around the coast of Florida. Plans are laid for various other airways, including one between Key West and Havana.

While no continuous services for aerial goods traffic exist in the United States, aeroplanes are often chartered for special deliveries. This is particularly the case in the oil countries of Texas and Oklahoma, where newly-grown and important centres are off the beaten railroad track. One company in Oklahoma regularly sends

its employees' pay by aeroplane from town to oilfield camp, thus assuring a quick and safe delivery, free from the necessity of armed guards and the danger of hold-ups. Other items worth noting in the United States' aerial history of the past twelve months are that aeroplanes have performed survey work and located forest fires, that thirty-two cities have applied for commercial aerodromes for postal, passenger, and express purposes, and that an advertising agency is obtaining aerial business that includes display work on dirigibles, balloons, and aeroplanes, the dropping of pamphlets from the air, and aerial photography.

Where the United States undoubtedly leads the way is in the ownership and use of privately owned aeroplanes; a circumstance partly explained by the great quantities of new money being spent. For a time, some of the American manufacturers were months behind their post-war orders, and were selling everything that could fly. One company disposed of hundreds of pleasure craft at £1,500 apiece. Many buyers, impatient of delay, accepted immediate delivery of training machines, rather than wait for the pleasure craft. Reputable agencies dealing in second-hand aeroplanes, bought from the United States and Canadian Governments, sold thousands of machines, and could not obtain enough craft to satisfy all their clients. An interesting development was the idea of community aeroplanes, purchased and maintained jointly by small groups of people living in the same residential district.

The United States postal authorities have maintained their aerial mail services over the route New York–Washington–Cleveland–Chicago. After some preliminary fiascos these became reliable, besides remaining very speedy as compared with train schedules. For June, 1919, the Washington–New York air mail achieved 99 per cent efficiency, and the Cleveland–Chicago route 100 per cent. The latter never missed a day in May and June, and not a single forced landing occurred during the first seventy days. At the close of 1919 the U.S. air mails showed a surplus of £3,000 of revenue over working costs, on a basis of 2 cents charge for each ounce of mail matter carried. Better results are expected now that specially

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constructed machines, with freight capacities of 1,000 lbs. and upwards, are ready for use.

The British dominions and dependencies take a great interest in aeronautics, and last year saw satisfactory beginnings in some of these. In Australia a passenger and freight service links Sydney and Port Darwin, over a distance of 2,500 miles, with intervening stations. Plans are ready for regular flights from north to south of the continent, and also from east to west, across the difficult country between New South Wales and Victoria on the one hand, and Western Australia on the other.

Canada has found a highly successful use for aeroplanes in prospecting the Labrador timber country. A group of machines returned from an exploration with valuable photographs and maps of hundreds of thousands of pounds' worth of forest land. Aerial fire patrols, also, are sent out over the forests. While no important air route for passenger carrying is yet utilised in Canada, there is a certain amount of private flying, and special air journeys for business purposes are common. Schemes have been prepared for a regular service between Newfoundland and cities on the mainland, thus saving many hours over the time schedule perpetrated by the little Newfoundland railway.

In the South African Union, where the railway system by no means corresponds with the vast distances, many passengers and mails are carried by air from Johannesburg to Pretoria, Maritzburg, Durban, and Cape Town. Later, when the services over these routes are better organised, they will doubtless be extended to important centres in Rhodesia, the East Africas, and what was German South-West Africa.

Aeroplanes in India take passengers over the route Calcutta-Simla in twelve to fifteen hours of cool roominess, as compared with forty-two hours of stuffy oppressiveness on a train. Other Indian air routes in preparation are Calcutta-Bombay, Calcutta-Darjeeling and Calcutta-Puri. The air fare in India averages about sixpence a mile.

Aerodromes and landing grounds are already prepared between



Alcock and Brown leaving the Clifden Wireless Station by different transport.

'We must have signed our autographs hundreds of times'—Alcock and Brown aboard the *Ulster* with Captain Newton.





Alcock and Brown at Clifden soon after arrival

Egypt and India, along the route followed by the several machines that have made the journey from Cairo to Delhi, via Damascus, the Syrian Desert, Bagdad, Bandar Abbas, and Karachi. Elsewhere in the East—the Malay Peninsula, Singapore, Borneo, Java, and China—similar routes are planned. The whole of Eastern Africa, from Cairo to Cape Town, has been mapped out for the use of aircraft, with landing grounds at short intervals.

So much for accomplishment during the past year. What the future and the near future have in store for aeronautics is problematical, and any detailed analysis must be conjecture. The general trend of development during the next two years may be forecasted, however, with a fair degree of accuracy.

Anybody who blends sane imagination with some knowledge of the history of aeronautics must realise that what has been achieved is little in comparison with what may be achieved. It is unnecessary to make trite comparisons with the first stages of steam locomotives or motor cars.

Yet it is folly to expect an air age now. Its coming will be delayed by the necessity of slow, painstaking research, and by the fact that in the countries which are encouraging aviation to the greatest degree, capital is no longer fluid and plentiful, and money in substantial sums cannot be risked on magnificent experiments. The cost of building fleets of dirigibles and hosts of air terminals must be enormous; and until it has been demonstrated beyond question that they will be paying propositions, financiers and investors are unlikely to be interested in their concrete possibilities on a large scale.

Unless some startling innovation—a much cheaper fuel, for example, or a successful helicopter—revolutionises commercial aviation, its near future is unlikely to stray beyond the extension of airways over distances of about 500 to 2,000 miles. These are likely to be covered mostly by heavier-than-air craft, although, as in Germany, dirigibles will have their place.

Extension of air traffic is especially probable in industrial and agricultural countries of large area, such as the United States,

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Canada, Australia, India, and the South American Republics. Another projected development with immediate possibilities is the linking of regions that are separated by a comparatively narrow expanse of water. Obvious examples, in addition to Britain and France, are England and Ireland, the Mediterranean ports of France, and the Mediterranean ports of Africa, and Florida and Cuba.

Traffic across the ocean or a great lake offers to air travel the best time-saving inducement. To connect two places separated by 150 miles of water, an average steamship needs ten hours. A passenger on it must spend at least one night away from home, while transacting his business. An air passenger makes the journey in $1\frac{1}{2}$ to 2 hours, and can return on the same day. For such transport the seaplane and the flying boat will have their chance.

Besides the carriage of passengers, mails, and valuable freight, aviation should have many additional functions. Maps may be made and checked with absolute accuracy by means of aerial photography. Another important function of the aeroplane and the aerial camera is to explore and prospect undeveloped districts. In places remote from the ordinary facilities of civilisation aircraft may be used for the discovery of fire, flood, and lawlessness. Already, the Canadian North-west Mounted Police have captured criminals by means of aeroplane patrols.

Aircraft offer particular advantages as carriers in regions where the natural obstacles on the ground prohibit railway or road transport. In Alaska valuable metals and furs are brought to civilisation on sleds drawn by dogs, over paths that are circuitous and dangerous. It is proposed to make an attempt to take them in safety, and with an immense saving of time, by aeroplanes fitted with skids suitable for landing on ice and snow.

Again, copper is transported from mines in the Andes by llamas, which are slow, and must jog over devious tracks. Aeroplanes could make the journey, directly and speedily, from mine to coast, without regard to precipice, marsh, or forest.

South America is likely to be a happy hunting-ground for

aeronautical pioneers. The mountain range of the Andes, which for hundreds of miles sharply divides America into two parts, gives aviation an incontestable opportunity. The eastern section of South America could be brought days nearer the western section by high-climbing aircraft, which would provide a pleasant alternative to the roundabout, uncomfortable journeying now necessary. Similarly, the air mails between the three great commercial centres of South America, San Paulo, Rio de Janeiro, and Buenos Aires should save days of valuable time. Many owners of ranches and plantations in the Argentine, Uruguay, Paraguay, and Brazil are now buying aeroplanes to bring their isolated up-country properties in closer contact with the towns.

Asia and Africa have similar geographical problems to which air traffic might find a ready solution. Each of these continents contains enormous areas that, because of the absence of good railways, are either unproductive or much less productive than their resources warrant. A few of many such cases are Turkestan, Central Arabia, parts of China, Siberia, Tibet, and the whole of Central Africa. Most of these regions are rich in minerals. Meanwhile, aeroplanes have flown between the desert parts of Damascus and Bagdad in eight to ten hours. These cities are not yet linked by railway, and a camel caravan over the Syrian desert covers the same route in two weeks to a month. The same conditions apply to the Gobi desert.

So far, I have dealt with the future of commercial aeronautics almost entirely in terms of heavier-than-air machines. These—land planes, seaplanes, and flying boats—have at present a useful radius of non-stop flight, confined to distances of under 1,000 miles. The limitation must remain until changes in the basic principles of aeroplane construction give much greater speed in proportion to fuel consumption.

Within this limit, however, the prospect is brightening. Already the new Handley-Page wing, the tests of which by the National Physical Laboratory have fully justified the inventors' claims that for a given result planes of half the present size will suffice, appears

likely to revolutionise aeronautics. It will allow machines to take off with a smaller run and to land in a smaller space; it will permit designers to increase the margin of strength, safety, and comfort; it can be utilised to produce greater speed; it can increase the 'useful load' on present types of aeroplanes by 20 to 40 per cent. When applied to machines designed and engined *entirely* for the needs of commercial transport (for it seems that a main reason for the comparative failure of commercial aviation in 1919 and 1920 is that the craft employed have been based on war models), it is scarcely too much to hope that the new style of wing surface may enable air transport to compete within limits of about 1,000 miles, on something like equal terms with transport by land and sea.

Moreover, we may find any day that one of the attempts, in various countries, to design and construct a successful helicopter has matured, producing a machine which, by reason of a very powerful propeller on a moveable shaft that can be inclined in any direction, will not only rise and descend vertically, but also can be made to travel forward at a great speed.

All this, however, is surmise; and we are faced with the fact that until the design of aeroplanes differs radically from its present form, heavier-than-air flying apparati are limited as to maximum size by certain structural principles too complicated for explanation in this non-technical analysis. A further limitation is imposed by the space needed by the largest machines for leaving the ground or landing.

Within these bounds it has been found that the maximum capacity for passengers and freight does not greatly exceed $1\frac{1}{2}$ to 2 tons for a non-stop journey of 500 miles in still air. Lesser distances do not increase the useful load appreciably, but greater distances decrease it; until, for a radius of about 2,500 miles, the whole of the disposable lift is needed for fuel, and nothing else may be carried.

On long journeys over land, therefore, the aeroplane must come to earth for replenishment of fuel every 500 miles. Even for this distance it cannot take more than $1\frac{1}{2}$ to 2 tons beyond the weight of fuel and crew. If heavier loads are to be transported, more

machines are necessary. Finally there comes a point at which a single airship, carrying a heavy freight over 500 miles, is more economical than several aeroplanes. For non-stop flights of over 1,000 miles, the same considerations make the airship always more economical than the aeroplane.

Over the ocean the flying boat can beat the dirigible in time and cost up to 500 miles. Even at 1,000 miles it is a commercial proposition, but it must then have all in its favour. For longer distances the airship has no competitor. It may be deduced that in years to come, when the world's airways are in general operation, heavier-than-air machines will bring freight to the great airports, there to be transferred to dirigibles, and by them carried to the earth's uttermost ends.

The time for this seeming Utopia is not yet, however; though plans have been formulated for dirigible services that eventually may place London within two and a half days of New York, one and a half days of Cairo, four of Rio de Janeiro, five and a half of Cape Town, and seven of Australia. But first must come bold expenditure, very careful organisation, many-sided research, and improved invention.

Although no claim is made that present-day airships can compete for reliability with railway trains and ocean liners, there is no doubt that a sufficient number of passengers are prepared to pay relatively higher rates for the great saving in time taken for long distance journeys, particularly over the ocean. The demand would be mainly for the carriage of express freight and mail matter, and for passenger traffic to serve people who wish to travel from centre to centre in the shortest possible time. Another use for large airships would be the carrying of freight of high intrinsic value from places otherwise inaccessible, or not provided with other means of direct transport.

To meet the requirements of various purposes for which airships may be utilised, dirigibles of four kinds are projected:

The airship of moderate size and high speed for carrying express, mails and passengers.

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The air liner solely for passenger traffic, of a large size and high speed.

The large airship of comparatively low speed and great carrying capacity, for general transport.

The small, non-rigid airship, for private purchase and upkeep as an aerial yacht.

The rigid airship is as yet only at the beginning of its development, particularly as regards size and carrying capacity. The airship of 3,500,000 cubic feet capacity, for the fast passenger services, carrying a load of passengers of 15 tons for a distance of 4,800 miles, might be built immediately, and could be housed in sheds at present available. As the lift and speed efficiency of a rigid airship increases rapidly in proportion to the vessel's size, it will be advantageous to use the largest airships that can be operated economically. A rigid airship, able to carry 50 tons of passengers and freight for 10,000 miles at a speed of 80 miles an hour, is feasible; and the design and construction of such a craft could be undertaken now if it were justified by the demand for air transport.

The ships of 3,500,000 cubic feet capacity, which can be housed and flown for commercial purposes as soon as the required terminals and navigational facilities are ready, should be most suitable for the first transatlantic service. If standardised for adaptation to all conditions and world routes, they would be capable of a non-stop flight of about 80 hours, at an average speed of 60 miles an hour.

To prevent wastage and reduce the running costs, several economical devices for dealing with height equilibrium are needed. On long flights the greatest problems are maintenance of the airship at a constant height, and avoidance of the loss of gas consequent on expansion when the ship rises as it loses weight by the consumption of fuel. Owing to the great variation in temperature between day and night, the ship becomes heavy at night, as a result of the lower temperature, and light during the day, as a result of the higher temperature. A discharge of ballast at nightfall and of gas in the morning, are needed to keep it in equilibrium. To

obviate discharge of gas and the necessity of starting with a large weight of ballast, it is proposed to run a proportion of the engines on hydrogen fuel, so that the hydrogen can be consumed at such a rate that the loss of lift equals the loss of weight of fuel consumed by the other engines, thus economically using hydrogen which otherwise would be lost through the discharge of the gas valves.

I make the supposition that hydrogen, and not helium, will be the sustaining gas. For commercial aviation it has many advantages, for helium is dearer and heavier, and has about 20 per cent less lift. Contrary to popular belief, a flight in an airship filled with hydrogen, subject to proper precautions, involves no greater fire risk than does living near a gas factory. Helium is a necessity only for airships used in war; as, unlike hydrogen, it is not ignited by incendiary bullets from hostile aircraft. The United States has almost a monopoly of the world's quantitative supply of helium, which fact should be a tremendous asset in war-time.

The ballast difficulty can be met by apparatus for condensing the water of combustion from the exhaust gases of the engines. Experiments have shown that it is practicable to recover water of slightly greater weight than the petrol fuel consumed, thus avoiding any variation in lift due to petrol consumption. Further, water ballast could be picked up periodically from the sea by descending and taking in water through a pump suspended from a flexible hose or direct into tanks in the gondolas through sea-valves.

Still further reduction of running costs may be effected by fuel economy. This would be difficult with internal combustion engines of the type in use at present, for greater thermal efficiency (the ratio between the amount of heat contained in the fuel consumed and the amount of useful work delivered by the engine) necessitates heavier machinery. The reduction in petrol consumption is thus offset by a decrease in the disposable lift. It is probable that on large dirigibles a saving might result from substituting for the internal combustion method of generating power the employment of engines that burn cheap oils. Although such engines are

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much heavier, and although the crude oils weigh a good deal more than petrol, the difference would be more than covered on long flights, for petrol is nearly four times dearer than crude oil. Moreover, the weight of oil consumed would be about 20 per cent less than that of the petrol burned by internal combustion engines over the same distance.

The solution may be in the employment of steam. For the rather low standards of horse power on which dirigibles are driven, heavy steam engines of the ordinary type, although much more reliable, would be less economical than internal combustion engines, owing to the latter's better thermal efficiency. Engineers are attempting to evolve a light type of steam turbine that will overcome this drawback.

Of equal importance to fuel economy is a better system of airship navigation. This is similar in principle to steamship navigation, but it is made more complicated by the much greater drift of atmospheric currents. Moreover, air currents can never be charted as exactly as sea currents. An excellent meteorological organisation, for reporting motions of the air at given times, is therefore essential.

When flying over land a navigator can determine the drift of his vessel by taking observation on a suitable fixed point on the earth's surface, and adjusting his compass course accordingly. It is probable that a gyroscopic compass will be the standard type for dirigibles. Many aviators have experienced difficulties with the magnetic compass on long flights, although I have always found it reliable, especially during the transatlantic flight.

Over the sea no fixed point is available, so that the motion of the wind must be checked periodically. One method is for the navigator to make astronomical observations, and from them deduce his position on the chart. Another may be the use of bombs which ignite on the water and give out a dense smoke or bright light, lasting for several minutes. During the day the navigator sights on the smoke, and during the night on the light, and thus discovers the wind's velocity and direction. An invention that

could simplify navigation would be some form of ground speed meter, showing at a glance the rate of progress over the earth, with either a following or contrary wind.

The most valuable means of airship navigation will be directional wireless. Communications from two separate stations, which could be either land terminals or stationary ships in the ocean, gives the direction of the transmitted wireless waves, and signals to the dirigible its bearings. The position is then laid off on the chart, and the course is regulated accordingly. This method was used by the German Zeppelins during the war.

Of equal importance to the structural and navigational equipment of airships is the provision of suitable airports for each route. These would require, among other necessities, an aerodrome of about one mile square, a double airship shed, capable of housing two vessels, a mooring-out tower, mechanical gear for transferring an airship from the mooring tower to the shed, hydrogen generating and storage plant, repair workshops and stores, meteorological offices, wireless telegraphy installation, electrical night signalling and landing arrangements, a station for a local railway from the main part of the city, an hotel, a garage, and customs and booking offices. The aerodrome must be a short distance from the city served by the airship service. If possible it should be near a chemical works where hydrogen could be produced as a by-product. The ground would be preferably on a site remote from hills and other topographical features likely to cause air disturbances.

The double sheds for housing vessels of the size specified—3,500,000 cubic feet capacity—would have two berths, the minimum dimensions of each of which must be 850 feet long, 150 feet wide, and 115 feet high. Their contents should include hydrogen filling mains, and gear for slinging the airships from the roof when deflated for overhaul. Special arrangements would be made for rapid replenishment of the ships with gas, fuel, and water ballast.

If no supply of hydrogen were provided by a near-by factory, the aerodrome should have a generating plant capable of producing 50,000 cubic feet of hydrogen per hour. Gasometer storage,

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with a capacity of about 500,000 cubic feet, is also a necessity.

The meteorological office would issue weather reports for the guidance of airship navigators, and issue navigating instructions to them by means of the wireless installation. The latter should have a range of at least 5,000 miles.

Each aerodrome would be provided with suitable electric light signals to indicate the position of the landing ground to incoming ships at night, as well as landing lights to point the way to the mooring tower. Trolleys running on guide rails, with electrically driven gear, could move a dirigible from the tower to the shed with a minimum of man power.

A suitable mooring tower constitutes an enormous saving of time and labour. The Vickers Patent Mooring Gear, which has been tested, can be worked by half a dozen men; whereas the old method of rope pulling and dragging needs two to four hundred men for landing an airship of 3,500,000 cubic feet capacity.

With existing methods, a rigid airship must be housed in a suitable shed when not in flight. The danger and difficulty of removing the ship from its shed and returning it safely thereto after a journey restricts the number of actual flying days in the year to those on which such operations can be performed without risk of damage; although a modern rigid airship may remain in the air with efficiency and perfect safety in almost any kind of weather. The Patent Mooring Gear renders the landing independent of the weather, while calling for the attendance of only six men.

In principle, the gear consists of a tall steel mast, of such a height that when the ship is attached by the nose it rides on an even keel at a height of upwards of 100 feet. The mast has at the top a platform or deck. The head of the tower is entirely enclosed, and contains the necessary apparatus for bringing a vessel to rest. This top portion is designed to rotate, so that a ship, when moored, may always lie directly head to wind.

The upper deck of the masthead is reached in a lift. Behind the deck is a compartment containing the landing gear. This consists of an electrically driven winding engine, fitted with about 1,000 feet

of the highest quality flexible steel wire rope, together with an automatic coupling. In the compartment are pipes for the supply to the ship of hydrogen, petrol, oil, and water from the main reservoirs situated on the ground at the foot of the mast. The vessel itself would be fitted with apparatus complementary to that housed in the masthead. From the nose projects the attachment which is gripped by the automatic coupling, while in the bow is situated a storage drum and winch for 600 feet of wire rope.

On approaching the aerodrome, the ship wirelessly its intention to land. The masthead mooring rope is then threaded through the automatic coupling, and paid out until the free end reaches the ground below. This end of the rope is attached by a shackle to the rear of a light car, which is driven away from the mast in the direction from which the ship is approaching, while the rope uncoils from the drum above. When at a distance of 700 or 800 feet from the foot of the mast, the men in charge of the gear unshackle the rope, and spread landing signs that indicate to the airship pilot their position on the ground.

On arrival over the landing party, the ship's bow mooring rope is released, and runs out from the bow attachment, under the influence of a weight of several hundred pounds in the form of sandbags. Two men of the party on the ground below take charge of the rope, unshackle the sandbags, and effect a junction with the mooring mast rope, which is in the hands of the remaining men of the landing party. The rope ends are coupled together by means of a self-locking coupling, which enables the junction to be made within five seconds.

The dirigible is now connected with the head of the mooring mast by a long length of steel wire rope. On receiving a signal from the ground party, the men in charge of the winding gear in the masthead haul in. As the rope tautens, ballast is discharged from the ship, which is slowly hauled into connection with the automatic coupling already set in the open position to receive the attachment on the nose. When once this coupling is closed, the

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mooring ropes can be dispensed with, the ship's rope being re-wound on to the storage drum in the bows.

After landing at the masthead, connection is made with the hydrogen, petrol, oil, and water mains, and fresh gas, fuel, and water ballast are placed on board, so that the ship may be kept in trim during the discharge of cargo, and the embarkation of passengers and stores may take place.

When the ship is ready to leave the masthead for flight, the pulling of a lever in the automatic coupling releases it. It then draws astern and upward, under the influence of the prevailing wind, until it is well clear of the landing station, and can proceed on its course.

The design of this apparatus is such that the landing of an airship is as easy in a strong wind as in complete calm. With its help an airship can land in any speed of wind in which it is safe to fly. Should the wind be so high (over 60 or 70 miles per hour) that the vessel cannot reach a given mast, it will always be possible to learn by wireless the nearest station at which favourable conditions allow it to come down.

The release of the ship from the mast can take place in any wind-speed. Owing to the comparatively local nature of a big storm (storms are known not to cover districts greater than 200 miles in diameter) the vessel, after slipping its moorings, is able to circumnavigate the disturbed area by making a small initial deviation from the true course.

A part of the aerodrome should be given over to aeroplanes, used for the bringing of mails and urgent freight to the terminal. Heavier-than-air machines, in fact, will be the veins leading to the great arteries of the world's air routes, operated by dirigibles. A strong searchlight, for the guidance of aeroplane pilots flying in fog, would be necessary. Given improved landing facilities, means might be found for them to coast down the searchlight if the ground away from it were invisible. Another method of delivering mails before leaving for a landing ground away from the fog belt, would be to drop them, attached to a parachute. When the pack-

age reaches ground it can be located by an electric bell, which rings on impact and continues ringing.

The mail services of today, by railway and boat, can in many cases be greatly speeded up if part of a long journey be covered by aeroplane. A good instance is the route between Great Britain and South America. If a merchant in London posts three letters to correspondents in New York, Rio de Janeiro, and Buenos Aires respectively, he may have a reply from New York before the Brazil man has had time to read his communication, and four or five days before the man in the Argentine has received his. An aerial short cut to Dakar—already several machines have flown thither from Paris—would lessen by six or seven days the transit time for mail bags sent from England to Rio de Janeiro or Buenos Aires.

As long as the internal combustion engine is used in aeronautics, and mechanical failure is always a possibility to be reckoned with, the cost of maintaining aeroplane routes, even if they be only auxiliary to dirigible or steamship services, will be greatly swollen by the need of maintaining frequent landing grounds. Every ten miles would be an ideal interval for them; every twenty miles is a minimum for first-rate insurance against risk. From a height of 5,000 feet, a pilot can without difficulty cover a distance of five miles while planing down without the aid of motors. From 10,000 feet he can cover ten miles under the same conditions, so that at this height he would never be outside gliding distance of landing grounds prepared every twenty miles.

Given these safeguards, the element of risk in present-day aviation is no greater than it was in the early days of railways and steamboats, and little, if any, greater than in modern motoring. Even nowadays, many people possessing only a newspaper acquaintance with aerial affairs still believe mechanical flight to be perilous. In exactly the same manner men shunned the infant steamboat, railway train, bicycle, motor car.

Proportionately, the aeroplane and the dirigible are responsible for no more deaths than the train or automobile. The seeming

Our Transatlantic Flight

discrepancy is because so much attention is paid to air fatalities. Every week-end motor car accidents cause dozens of fatalities. Yet the death in harness of a single aviator produces more comments than all of these. Partly, no doubt, the intense horror with which humanity regards death by falling from a great height is due to its novelty among human experience.

As regards airways, the air routes of the world are still hypothetical; but some of their main terminals, in relation to the centres of industry and population and the trade routes, will certainly be London, New York, San Francisco, Tokio, Delhi, Colombo, Cairo, Cape Town, and Rio de Janeiro. In particular, London, New York, Cairo, and Rio de Janeiro are fitted to be great junctions for air traffic.

London is the logical distribution centre for passengers and freight from North and South America, bound for Continental Europe or the East. The New York terminal should link the transatlantic airways from Europe with the airways of North America. Rio de Janeiro should perform the same function for South America, and also be the centre of seaplane traffic up the Amazon and along the coast.

Cairo is destined to be the junction of the air routes between Europe, Asia, Africa, and Australia. From it dirigibles or aeroplanes may pass to India (via Damascus and Bagdad), to Cape Town (via Nairobi), to Australia (via Aden and Colombo, or Delhi and Singapore), and to London (via Algiers or some point in Southern Italy). Cairo is also likely to be the base for seaplanes and flying boats plying up and down the tremendous waterways of the Nile and the Great Lakes.

The British Empire is especially bound up with the airways of the future. The geographical position of the Briton forces him to think in Imperial terms. In 1776 Great Britain lost her most valuable colonies largely because the Atlantic Ocean made adequate representation of the colonial interest physically impossible. Since that day cables, steamships, and the wireless have helped to overcome the distances that separate the overseas dominions from

the British Isles. An imperial pattern of well-organised air routes should be of the greatest help in the consolidation of the far-flung Empire.

To this end British officials mapped out the stages of the aerial route to Australia from Egypt, via Damascus, Bagdad, Karachi, Delhi, Calcutta, Singapore, and Sumatra. Although the successive landing grounds were not ready in time for Capt. Ross-Smith's magnificent flight, the information and advice collected by official surveyors was of inestimable value to him. It is noteworthy that nearly the whole of the proposed airway from Egypt to Australia is over British territory or the sea.

The same is true of the proposed route from Cairo to Cape Town. Col. van Ryneveldt, like Capt. Ross-Smith, owed much of his success to the military aviators who prospected for aerodromes. Under the most extraordinary difficulties, three parties covered the length of civilised and uncivilised Africa in their search for landing grounds along the all-British corridor from Cairo to Cape Town.

Being the junction of the airways to India, Australia, and South Africa, Egypt is destined to be the nerve centre of an air-linked Empire, just as the Suez Canal has been its jugular vein. But the laying out of great air routes to the East and South does not complete Britain's plans. She must connect them up with London—a task which is much more complicated from the standpoint of high politics, because it involves routes over the territory of other nations. An aeroplane can fly from London to Cairo, via Gibraltar, without passing over foreign territory or foreign territorial waters. This route would be long, however, and the aerodrome bases great distances apart, in comparison with the proposed land route of 2,000 miles across France, down the length of Italy and Greece, and across the Mediterranean to Cairo. Such a route necessitates a cordial entente of the air with the nations of Western Europe, and is one of the reasons why we can never contemplate easily a loosening of the bonds that now hold together the Allies of Western Europe.

The French, for their part, are also thinking of air routes in

Our Transatlantic Flight

terms of their colonial possessions. For them the international situation is much the same as for the London-Cairo airway. French pilots need not fly over foreign territory to Algiers or Morocco. A long flight across the Mediterranean, or skirting the west coast of Spain, is a possibility. But Spanish territory is the logical corridor from France to Africa. It was over Spain that a trip was made from Toulouse to Casablanca, the 1,800 miles being covered in eleven hours of actual flying. The ordinary postal service takes six days. For direct aerial communication with Syria, also, France must have an entente with the various intervening countries.

When technical progress and perfected organisation place the world's main airways in operation there will be enormous saving of time on the longer routes. Estimated times for transatlantic flights have already been given. In many years to come, with the development of airship transport to the most distant centres of the world, it is conceivable that no important city will be further from London than 10 days' journey. The following table, as applied to a London terminal is by no means fantastic:

TO NEW YORK	2-2½ DAYS
„ SAN FRANCISCO	4½ DAYS
„ CAIRO	1½ DAYS
„ COLOMBO	4½ DAYS
„ PERTH	7 DAYS
„ NAIROBI	3½ DAYS
„ CAPE TOWN	5½ DAYS
„ RIO DE JANEIRO	4 DAYS

As the maximum distance of direct flight between intermediate stations is not more than 3,600 miles, it would be practicable to run these services with the size of airship described (3,500,000 cubic feet capacity). The cost of operation for regular services would be approximately as for the Atlantic service. Passengers at the rate of 4d. per mile, and mails at the rate of 3s. per ounce. With the development of larger airships, carrying greater loads, the cost should be more economical.



Alcock chaired by an enthusiastic crowd on the journey to London.



Setting out from Euston Station (*top*) for 'an exciting and pleasant drive to the Royal Acro Club' (*bottom*). Alcock clutches the bag of transatlantic mails.



The Air Age

I admit that such a near-utopia of an air age may not be seen by the present decade, and that its attainment demands great results from science, statesmanship and business organisation. Yet, even to come within sight of world intercommunication as rapid as is indicated by the signposts of present-day aeronautics would make possible an era of greater prosperity and peace. If people, their written communications, and their goods can be taken from continent to continent as quickly, or nearly as quickly, as cablegram, the twin evils of state parochialism and international misunderstanding will less often be dragged from the cupboard in which the world's racial skeletons are kept. The airship and the aeroplane may well become a greater influence towards internationalisation than a signed covenant of the League of Nations.

PART III

As it Seemed Afterwards

by Captain John Alcock

As it Seemed Afterwards

THE Vimy made its landfall in Ireland on the evening of Sunday, 15th June and so it was the 'night extra' edition of the *Sunday Evening Telegram* which scooped the news of 'the great British air triumph'. The next morning, the leading dailies had their chance.

The Times, Monday 16th June, 1919

The direct flight of the Atlantic, from continent to continent, comes with all the more effect from being the climax of a series of cross-ocean flights. . . . Captain Alcock and Lieutenant Whitten Brown had no landsman's crossing. They started in perilous fashion and with a real risk of ruining their hopes before they could get into the air; and even when they had escaped the type of disaster that overtook Raynham and his Martinsyde machine, their flight was beset by fog and ice-sleet. It must be an unpleasant experience to find that you are flying upside down—even though it is a common enough experience of the air in foggy weather—when the Atlantic heaves beneath you and undeviating directness is a prime condition of success. . . .

Unless we are much mistaken, Captain Alcock and his companion do not want to be overwhelmed by thoughtless applause. They have attempted, and have performed, a feat which is a great step forward in human accomplishment. But it is a step, not a finality. . . .

The Vickers Vimy machine has won the £10,000 prize offered by the *Daily Mail* for the cross-Atlantic flight—NC.4, of course, was not a competitor—and it is almost pathetic now to recall the comments of British officialdom and its sycophants when fears for the safety of Hawker and Grieve seemed only too well founded. But after all, the official tradition in this country of leaving pioneer work to private endeavour—with a substantial reserve of disapproval in case of failure—dates back at least to that gaunt patroness of official meanness, Queen Elizabeth. It is our way, but we question whether the country can afford to keep it so far as civilian flying goes. The Americans, with NC.4, have shown us that there is another way and a very efficient way; and they may be assured that we realise its merits and appreciate its accomplishment, even if we reserve our heartiest transports for the work of our own men, done in our habitual way.

These congratulations are expressed in the many messages, which we print today, sent to Captain Alcock and to Lieutenant Whitten Brown. The King

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157, Wardour St.
W. 1.
Phone Gerard 3623.
Bands for—
SLIPPERS
DANCING
JAZZING
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RIVER TRIPS
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All the Celebrated Bands.

Sunday Evening Telegram

NIGHT EXTRA



No. 143.

TELEPHONE 222

SUNDAY, JUNE 15, 1919.

PRICE THREE-HALF-PENCE.

GREAT BRITISH AIR TRIUMPH

Vickers-Vimy-Rolls Machine Crosses the Atlantic.

LANDS IN IRELAND THIS MORNING.

CLIFDEN, IRELAND, Sunday.

Captain Alcock and Lieut. Brown, the Atlantic fliers, in Vickers-Vimy-Rolls bombing machine arrived at Clifden (Galway), West of Ireland, shortly before 10 a.m. to-day, after about 16 hours' flight.

The landing was very difficult owing to the boggy nature of the ground.

The fuselage was buried at the nose.

Captain Alcock said: "We are tired of this, alone in the fog and drizzle, sometimes discovering that I was flying upside down. The wireless propeller blew off soon after leaving St. John's, and we were much jammed by strong wireless signals not intended for us."

Both occupants are in good spirits.—Wireless Press.

CONGRATULATIONS FROM HAWKER.

BRITISH SUPREMACY MAINTAINED

AN AMAZING ACHIEVEMENT.

(“Telegram” Special)

Mr. Hawker, one of the representatives of the “Sunday Evening Telegram” to-day, said:—

“I think it is a very, very fine performance indeed.

“They must have had exceptionally good weather to enable them to maintain the wonderful speed average which they did.

“The navigation, too, must have been really extraordinarily good.

“I am sending off my heartiest congratulations to Captain Alcock and Lieutenant Brown, as soon as I can find out what telegraphic address it is likely to find them for the rest of the day.

“The only regret, I think, is that I was not able to be at Clifden to congratulate the conquerors of the Atlantic personally.

“There is, of course, always an element of luck in such enterprises, but the Vickers Vimy achievement is really, as I am sure, an amazing one. I am more gratified than I can say that British air supremacy has been maintained by British aviators, and a British machine has made the first successful crossing.

“GREAT AND GRATIFYING.”

Mr. J. B. Fowler, of the Reynolds Company, in the absence of Mr. Hop with, said: “As the firm which supplied Mr. Hawker's aeroplane, we wish to congratulate Captain Alcock and Lieutenant Brown on their achievement. It is a great and very gratifying feat.”

MISS KENNEDY DELIGHTED.

A DAY OF REJOICING AT HER EALING HOME.

Major D. H. Kennedy, father of Miss Kennedy, to whom Lieutenant Brown is shortly to be married, gave a representative of the “Sunday Evening Telegram” the following message this afternoon:—

“After a night of great anxiety we are tremendously relieved and delighted at the success, were especially in view of the fact that the navigator has succeeded in reaching the place that he aimed for—namely, Galway.

“The flight is, of course, a splendid performance, 171 hours for 1,800 miles.

“We are celebrating the performance here. We have got the whole front of the house decorated, and a few neighbours and friends are rejoicing with us.”

“Miss Kennedy,” said Major Kennedy, “is very delighted—almost overawed.”

FLYING TO HIS BRIDE.

SUCCESS TO END IN MARRIAGE BELLS.

Lieutenant Brown was impatient to be off on his experience which may be accounted for by the fact that he was literally flying to his bride, for arrangements were on foot for the immediate celebration of the wedding of Lieutenant Brown and Miss M. E. Kennedy, daughter of Major D. H. Kennedy, one of the chiefs of the Aircraft Production Department of the Ministry of Aircrafts, Kingston.

Both the lieutenant and his fiancée were confident of success, and their confidence has now been fully justified.



Capt. ALCOCK, one of the fliers.

We in Britain are proud men and women to-day. We are a great deal better than we were a few years ago. We are a great deal more united, and we are a great deal more confident. And so it is that we take the deed of Captain Alcock and Lieutenant Whitman Brown as a tribute to the courage and valour of our race.

When the sunsets of flight are written in the years to come, this deed of the fliers of gold, and our children shall feel proud of the deeds of the men who crossed the Atlantic during the war.

A few weeks ago the flight to the Arctic was made by American aviators, and we were glad to see them. Now we are glad to see them. Now we are glad to see them. Now we are glad to see them.

From American aviators to European aviators, there have been a long list of successful results. But there is after all no comparison between that flight, great as it was, and the one which has just been accomplished by Captain Alcock and Lieutenant Brown.

The machines were British designed and British built, the aviators were British born. They belong to our country.

AERO CLUB'S WELCOME.

PREPARATIONS FOR ARRIVAL IN LONDON.

The keenest gratification was expressed by members of the Royal Aero Club at the Vickers Vimy triumph.

It is really a marvellous feat, said a member. “Some of us anticipated that the Transatlantic flight could be completed in such a short space of time. It is a marvellous performance.”

The Aero Club sent a congratulatory wireless message to the aviators this afternoon, and preparations are already in progress to give them an official welcome at the Club on their arrival in London.

(Continued on Back Page.)

R 84'S SUCCESSFUL TRIAL.

ATLANTIC FLIGHT IN A FEW DAYS.

Last night, at about nine o'clock, the great machine R 84 left her shed at East Fortune aerodrome, Haddingtonshire, on a final trial flight in order to test the wireless apparatus and other mechanisms prior to proceeding across the Atlantic.

The manoeuvres were carried out over the Haddingtonshire coast, followed by a flight over the Firth of Forth, and it is understood that the trial proved very satisfactory from every standpoint.

The aviator will probably attempt the Transatlantic flight in a few days.

Read this before going on your Holiday.

EVERY R 8 is built to endure. It is built to last. It is built to give you the most complete and reliable service of any motor car in the world.

The ROVER 8 is built to endure. It is built to last. It is built to give you the most complete and reliable service of any motor car in the world.

Write today for full particulars, price, and delivery. Ask for Sample Form No. 100.

ROVER 8

STAR & DOMINION

HEAD OFFICE, BRITISH DOMINION HOUSE, ROYAL EXCHANGING AVENUE, LONDON, E.C. 1.

As It Seemed Afterwards

has sent them one—simple and heartfelt, as is his fortunate habit—and the Chiefs of the Air Service. We hope too that there will be many who will read Lord Northcliffe's letter to them, because it gives words to the faith of believers in the great future of flying.

These extracts appeared in the editorial column of *The Times* on Monday, 16th June 1919. The *Manchester Guardian* was more reserved; after commenting that 'everyone, and particularly everyone in this city, will congratulate them most warmly on their daring, skill, and vitality', their editorial went on to say:

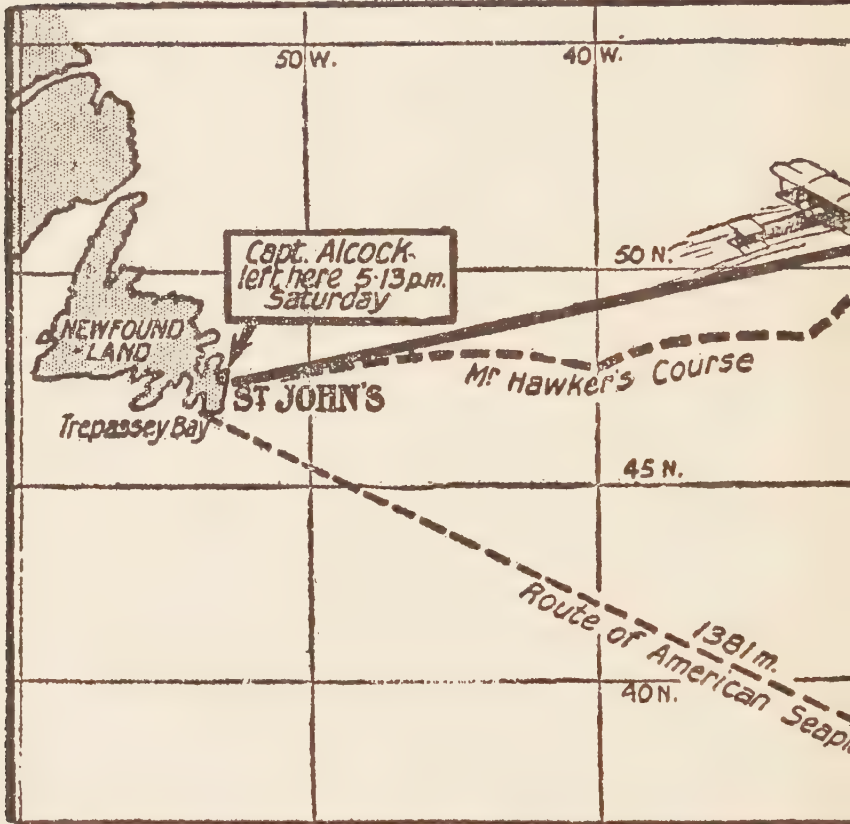
The success of Captain Alcock and Lieutenant Brown, while proving, not for the first time, that they are very gallant men, does not, it must be confessed, prove much else. . . .

As far as can be foreseen, the future of air transport over the Atlantic is not for the aeroplane. It may be used many times for personal feats of daring. But to make the aeroplane safe enough for business use on such sea routes we should have to have all the cyclones of the Atlantic marked on the chart, and their progress marked in from hour to hour. . . .

The *Manchester Guardian* was tipping the airship for commercial transatlantic flying. At first they seemed to be right—and the airship's position as the main transatlantic passenger-carrier seemed impregnable. But then they were overtaken by a series of disasters by fire, entailing heavy loss of life. There was then no suitable gas available which was not inflammable. Fortunately, my brother and many others continued to believe in the aeroplane.

This is not to say that the arguments put forward for the airship, and in particular those advanced by Brown in the final chapter of Part II, are not cogent. Much of what Brown forecast was to become fact and the airship has its supporters to this day. The difficulty lay, in those days, in the fact that airships had to rely on highly inflammable gases to become airborne; nowadays it is possible to produce a suitable non-inflammable gas quite cheaply. Even so, the record of the airship services across the Atlantic between the two world wars makes impressive reading and their reliability was only forgotten in the horrified public reaction to the total destruction by fire of the *von Hindenburg* at Lakehurst in

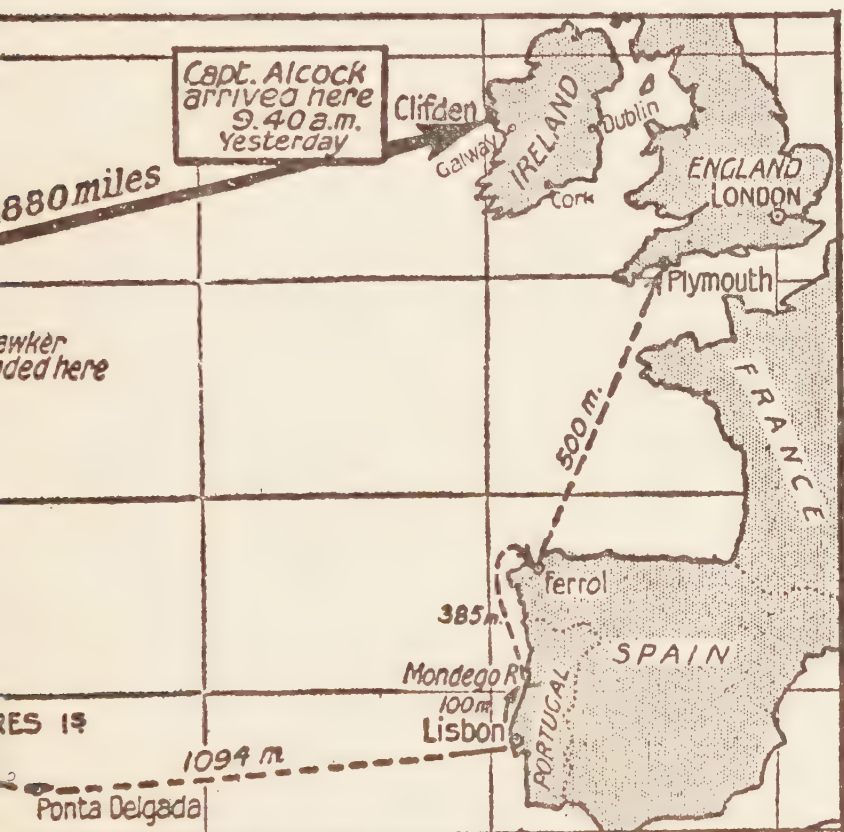
"DAILY MAIL" £10,000



The chart shows Capt. Alcock's route, compared
the U.S.

7, JUNE 16, 1919.

ATLANTIC PRIZE WON.



t. of Mr. Hawker, and also that of Cdr. Read in
e N.C. 4.

Our Transatlantic Flight

the United States in 1937; nearly forty people lost their lives in the disaster, which was caused by static electricity transmitted from the mooring tower.

Lord Northcliffe, that great supporter of the aircraft, was also first and foremost a great journalist; this is reflected in his letter to Alcock, written when he was already a sick man.

My dear Alcock

A very hearty welcome to the pioneer of direct Atlantic flight. Your journey with your brave companion, Whitten Brown, is a typical exhibition of British courage and organising efficiency.

Just as in 1913, when I offered the prize, I thought that it would soon be won, so do I surely believe that your wonderful journey is a warning to cable monopolists and others to realise that within the next few years we shall be less dependent upon them unless they improve their wires and speed up. Your voyage was made more quickly than the average Press message of 1919. Moreover, I look forward with certainty to the time when London morning newspapers will be selling in New York in the evening, allowing for the difference between English and American time, and vice versa in regard to the New York evening journals reaching London next day. Then we shall no longer suffer from the danger of garbled quotation due to telegraphic compression. Then, too, the American and British peoples will understand each other better as they are brought into closer daily touch.

Illness prevents me from shaking you by the hand and personally presenting the prize. But I can assure you that your welcome will be equal to that of Hawker and his gallant American compere, Read, whose great accomplishment has given us such valuable data for future Atlantic work.

I rejoice at the good augury that you departed from and arrived at those two portions of the British Commonwealth, the happy and prosperous Dominion of Newfoundland and the future equally happy and prosperous Dominion of Ireland.

Yours sincerely,
Northcliffe.

As It Seemed Afterwards

From our own correspondent.

Clifden, Sunday.

On landing Lieutenant Brown said to Captain Alcock: 'What do you think of that for fancy navigating?'

'Very good', was the reply, and they both shook hands.

The *Daily Mail* correspondent was one of the first newspapermen at Clifden to congratulate my brother and Brown. They were in the Officers' Mess of the wireless station, packing up their flying gear; Brown was busy stowing his sextant. The correspondent recorded their reactions: 'Captain Alcock's big, ruddy face just lit into a smile, and Lieutenant Brown bent further over his sextant and said simply, "We didn't do so badly, did we?" They might have come ten miles.' Alcock told him with a laugh that he was not at all tired, but Lieutenant Brown confessed, 'I am a bit fagged out.'

Later in the morning, Brown cabled the good news to Kathleen Kennedy, his fiancée:

Landed Clifden Ireland safely this morning. Will be with you very soon.

Teddy.

He got a reply in the early afternoon:

Magnificent—never doubted your success. Wire when leaving for Brooklands. Will meet you there.

Micki.

Of the actual flight, my brother gave a description to the press on arrival which includes some interesting details which he omitted from his later article in the *Badminton Magazine*. It was featured in the *Daily Mail* on the day after their arrival in Ireland.

THE PILOT'S STORY

By Captain J. Alcock, D.S.C.

Clifden, Sunday Night.

We have had a terrible journey. The wonder is we are here at all. We scarcely saw the sun or the moon or the stars. For hours we saw none of them. The fog was very dense, and at times we had to descend to within 300 feet of the sea.

POST OFFICE TELEGRAPHS.

This Form must accompany any inquiry respecting this Telegram.

Office of Origin and Service Instructions.



Clifden Radio Station
Via London 12.55

Received here at 2.19

TO Miss Kennedy
26 Oakley Avenue Baltinglar
Landed Clifden Ireland safely
this morning Will be with
you very soon Teddy



Replied 2.15pm
Lieut. Whitten-Brown

Clifden Radio Station
Via London to Galway

Magnificent - Never doubted your success
One when leaving for Brooklands -
Will meet you there
Miki

As It Seemed Afterwards

For four hours the machine was covered in a sheet of ice caused by frozen sleet; at another time the sleet was so dense that my speed indicator did not work, and for a few seconds it was very alarming.

We looped the loop, I do believe, and did a very steep spiral. We did some very comic 'stunts', for I have had no sense of horizon.

The winds were favourable all the way: north-west and at times south-west. We said in Newfoundland we would do the trip in 16 hours, but we never thought we should. An hour and a half before we saw land we had no certain idea where we were, but we believed we were at Galway or thereabouts. Our delight in seeing Eashal Island and Turbot Island (5 miles west of Clifden) was great. People did not know who we were when we landed, and thought we were scouts on the look-out for the 'Vimy'.

We encountered no unforeseen conditions. We did not suffer from cold or exhaustion except when looking over the side; then the sleet chewed bits out of our faces. We drank coffee and ale and ate sandwiches and chocolate.

The flight has shown that the Atlantic is practicable, but I think it should be done not with an aeroplane or seaplane, but with a flying boat. We had plenty of reserve fuel left, using only two-thirds of our supply.

The only thing that upset me was to see the machine at the end get damaged. From above, the bog looked like a lovely field, but the machine sank into it up to the axle and fell over on to her nose.

The *Daily Mail* reporter also included an account of a conversation with my brother giving a fuller account of the incident in the early hours of Sunday morning.

We never saw the sun rise. There was a bank of fog also on top of the lower one.

We climbed up to 11,000 ft. It was hailing and snowing. The machine was covered with ice. That was about 6 o'clock in the morning, and it remained like that until an hour before we landed. My radiator shutter and the water temperature indicator were covered with ice for 4 or 5 hours.

Brown had continually to climb up to chip off the ice with a knife. The air speed indicator was full of frozen particles and gave trouble again. They came out when we got lower, an hour before we landed.

We came down and flew over the sea at 300 ft. It was still very cloudy, but we could see the sun as he tried to break through. It was a terrible trip.

My brother told me afterwards that if Brown had not climbed out on the wing to clear the ice, they would never have made it.

Our Transatlantic Flight

The main problem was that they were flying blind in freezing fog and the pilot was therefore absolutely dependent on his instruments to tell him whether he was flying level or not; he could tell if the plane was banking sideways through the seat of his pants, just as the driver of a car can, but it is almost impossible to tell if a plane is climbing or diving except through the elevators: excessive pressure would tell him he was diving; if they went sloppy he would know that the nose was up. But icing completely distorts the message of the elevators. The Vimy had two instruments which would give the pilot the necessary information. The first was the airspeed indicator—if the aircraft was diving, the speed would increase, but if the aircraft started to climb, the speed would fall off. The second was the revolution-counter—there were two on the Vimy, one for each engine, but either would serve. A sudden increase in revs would indicate that the plane was diving; a sudden loss of revs would show that she was climbing dangerously steeply. Without either of these instruments, and with icing seriously affecting the trim of the plane, my brother could not have kept the plane in the air.

Unfortunately both instruments were mounted outside the cockpit. The icing rendered the two rev counter dials, mounted by the engines, unreadable; then ice blocked the intakes of the two tubes, the static and pitot, which worked the airspeed indicator. It was these that Brown had to clear, if the plane was not going to dive into the Atlantic or go into such a steep climb that she would stall. And to add to their problems the ice was blocking the air intakes to the carburettors; these too, Brown had to clear.

It is worth noting here that Brown did not include these episodes in his account of the flight, which is otherwise so detailed.

Brown has described their triumphant journey from Galway to London, but the description of their train's arrival at Chester, by *The Times* correspondent who travelled on the train, seems to capture something of the atmosphere which Brown himself was too modest a man to put over. The train stopped at Chester

station for a civic reception, and also halted briefly at Crewe.

Amid the cries the voice of Lancashire seemed to dominate that of Cheshire, and suggested that people had travelled from Manchester to see the newly famous son of their city. 'Good old Lancashire!' shouted a man of the merchant class. 'Ay, good owd Lankersheer!' echoed a railwayman. 'Manchester again!' cried another enthusiast.

Captain Alcock stepped out onto the platform, and Lieutenant Brown, after a little hesitation, followed him. . . .

In Crewe station there was yet another crowd, which quickly found the saloon, and insisted on the airmen leaving the train during the halt. Shout clashed with shout. 'Good luck as long as you live!' called one man. 'Which is Alcock? He's my namesake!' said another. A burly worker stretching his hand over the medley of others exclaimed, 'Put one in here, Mr Alcock, and God bless you.' Women and men struggled together to touch the Captain or the Lieutenant—both for preference—and imperative demands from the rear end ended in a kind of slow procession past the saloon door. Suddenly an Australian soldier called to a porter 'Up with him', and Lieutenant Brown was lifted shoulder-high so that all the people could see and cheer him. Another soldier with assistance hoisted up Captain Alcock. Then the whistle blew and the throng had to let them go. Both men by now were beginning to be a little exhausted by their reception, and expressed some nervousness about what would happen in London.

At Rugby Lieutenant Brown's shyness must have finally got the better of him, for instead of leaving the train to greet Miss Kathleen Kennedy, his fiancée, who, with her father, Major D. H. Kennedy, had travelled to meet him, he remained in the saloon, and Miss Kennedy, pretty, slim, tall and daintily dressed, stepped into the carriage. Captain Alcock promptly jumped out to face the enthusiastic crowd and to write more autographs, and then before the train left, brought Lieutenant Brown and Miss Kennedy arm in arm to the door to get their share of the cheers.

The train pulled into Euston at last on the afternoon of the 18th June. An open Rolls-Royce car, draped in flags, was waiting to drive them to the Royal Aero Club.

The official reception party on the platform was all but swamped, as the crowd surged forward. Sir Andrew Caird welcomed them on behalf of Lord Northcliffe and the *Daily Mail* and then the crowd moved in.

Our Transatlantic Flight

Captain Alcock was seized and carried swiftly and efficiently by stalwart policemen and lifted right over the side of the waiting car, to drop gratefully into the seat. A moment later stentorian yells of 'Gangway for Brown!' parted the surging multitude around the car, and the navigator appeared, smiling and on foot.

General Swinton and General Groves fought their way to the steps of the car and shook hands with the aviators. General Groves then handed to them, amid renewed cheering, messages from General Seely (Under Secretary of State for the Air Department) and Major General Sir Hugh Trenchard.

General Seely, writing on behalf of the Air Council, the Air Ministry 'and, I know, your comrades of the Royal Air Force' offered his most cordial congratulations:

We rejoice that your skill and courage surmounted all difficulties, and enabled you to cross direct from one continent to another by air.

General Trenchard's notes to each officer ran:

On behalf of the Royal Air Force I wish to congratulate you on the first successful crossing of the Atlantic Ocean by air without a stop.

And so they were driven to the reception at the Royal Aero Club, which was only to be the first of many such celebrations. On 20th June came a luncheon at the Savoy, given by the *Daily Mail*. Mr. Winston Churchill, then Secretary of State for War, presented the cheque for £10,000, and also revealed in his congratulatory speech the news of King George V's award of a Knight Commandership of the Order of the British Empire to both fliers; they were commanded to go to Windsor the next day to receive the accolade from the King. The *Observer* reported:

The King yesterday afternoon at Windsor Castle, conferred upon Captain J. Alcock, D.S.C., and Lieut. A. Whitten Brown, who made the first direct aeroplane flight across the Atlantic, the Knight Order of the British Empire. His Majesty congratulated the airmen upon their great feat, and with other members of the Royal Family, had an interesting chat with them.

They went down to Windsor by train and after a full civic reception at the station drove to the Castle in a Royal carriage, drawn by a pair of greys, and received a great ovation from the Eton boys, who surrounded the carriage and ran with it to the Castle, waving their top-hats and cheering.

When Captain Alcock and Lieut. Brown left Windsor Castle there was another enthusiastic demonstration. At the railway station, where a special



Winston Churchill presenting the *Daily Mail* cheque for £10,000 to Alcock.

Alcock and Brown arriving at Windsor Station on their way to be knighted by King George V, Saturday, 20th June, 1919.





The garden party given by Commander Trevor Dawson, Director in charge of armaments at Vickers, at his house at Elstree. *Left to right:* Sir John; Mrs Trevor Dawson; Mrs Douglas Vickers, wife of the Chairman; Sir Arthur; and Miss Kathleen Kennedy.

As It Seemed Afterwards

train had been placed at their disposal, they were surrounded by Eton boys and ladies anxious to get their autographs, and it was with the greatest difficulty that the officials got them into the train.

And this marked the end of the story as far as it concerned the two men personally. As recounted earlier, my brother was killed in a flying crash at the end of the year and Brown, who had become a very close friend, seems to have been permanently affected by his tragic death; he never flew again. Brown's only son was killed flying over Arnhem in the Second World War, and he himself died in 1948. Kathleen Kennedy, whom he married soon after the epic flight, survived him by a few years.

Their record stood unchallenged for eight years—in spite of numerous attempts on it—until Lindbergh flew the Atlantic non-stop from New York to Paris flying solo in his *Spirit of St. Louis*.

PART IV

Earlier Venture

OUR ATLANTIC ATTEMPT

by H. G. Hawker

Our Atlantic Attempt

EARLY on Sunday, May 18th, the Sopwith 'Atlantic' aeroplane was all ready, tanks filled, and everything aboard, and after saying 'au revoir' to all our friends, sending our respects (and hopes of seeing him at Brooklands) to Raynham, and getting the Rolls-Royce engine nicely warmed up and ticking over contentedly, we got in and pushed off at 5.42 p.m. Greenwich time, that is 3.40 p.m. Newfoundland local summer time.

Getting off was just a bit ticklish. The wind was about twenty miles an hour east-north-east, and that meant that we had got to go diagonally across our L-shaped ground, just touching the hill that I have mentioned, and avoiding, if we could, a deepish drainage ditch which ran along the foot of it. All our trial flights both in England and in Newfoundland had been done with three-quarter load of petrol, and we knew very well that there would not be too much room with the full load on board.

However, all was well. The going was rough and the hillside made her roll a bit, but we missed the ditch by inches and got into the air all right with a respectable distance to spare between our wheels and the trees. As soon as we were well up I throttled down and we started a steady climb out towards the Atlantic and towards the Ireland that we hoped to see inside the next twenty-four hours.

As soon as the coast had been passed, I pulled the under-carriage release trigger and away it went into the water. Simultaneously the finger of the air speed indicator went over to another seven miles an hour.

The sky was bright and clear to start with, but we had not got up many thousand feet, and I think had only been flying about ten minutes when we saw that Newfoundland's staple product—fog—was hanging on to her coasts. But that didn't worry us very much. The fog is never more than a few hundred feet thick, and we knew we should soon be leaving it behind. Grieve had been able to

Our Transatlantic Flight

observe the sea long enough to get a fair drift reading, and the fog bank didn't interfere with his navigation as it gave him the sort of horizon he wanted, being quite flat and distinct.

As far as the weather was concerned everything looked quite nice for some hours. We were comfortably jogging along at about 10,000 feet with nothing much in the way of cloud between ourselves and the vault of heaven, with the engine roaring contentedly as though it did not mean to misfire until the tanks were bone dry, and with the air speed indicator showing a decent 105 miles an hour. There were practically no bumps, and I could pretty well let the machine fly itself so long as I held her on the course that Grieve had laid down.

About 10 o'clock all the blue in the sky had turned to purple, the warm glint of the sun had faded from the polished edges of the struts, and the clouds below us became dull and patchy and grey, only giving us very infrequently a sight of the ocean beneath them.

A quarter of an hour later the weather conditions had noticeably changed for the worse. The sky became hazy and thick so that we could not see anything below us with any distinctness, but we could perceive clearly enough that there was some pretty heavy stuff ahead. However, there was only one thing to do. It wasn't very solid so we just poked our nose into it and pushed through, but it was quite decidedly bumpy, and now and then a slant of rain would splash on to us. But that didn't matter a bit, we were quite warm and comfortable and were expecting very soon to be able to leave this little patch of nasty weather behind us.

At about 11 (Greenwich mean time) I glanced at the water circulation thermometer and saw that it was a good bit higher than it ought to have been, although we were still slightly climbing. It was clear enough that everything was not right with the water, as the temperature did not go down as I expected it to when I opened the shutters over the radiator a little. However, we carried on, but we didn't seem to be able to get rid of the clouds which now began to appear thicker and heavier than ever,

and there was enough of them at lower levels to prevent any chance of our peeping at the sea.

By this time we had altered course a little to the northward, as from the information we had received at starting from the meteorological station we were expecting that the wind would tend to go more into that quarter. But it was none too easy for a decent course to be held, as the cloud formations we were running into were very formidable, and to say the least of it not without bumps. They were too high for us to climb over without wasting a good deal of petrol which we wanted naturally enough to economise in every way, and another reason why we didn't want to climb was the increasing temperature of the water. So we just had to go round the clouds as best we could, but there were so many of them that Grieve never had a chance to take a sight on the stars.

A little later the moon rose and brightened things up, and the outlook could do with a bit of brightening. The water temperature in the radiator had risen from 168 degrees to 176 degrees Fahrenheit, in spite of the shutters being quite wide open, and it was quite obvious that something serious was amiss; otherwise the Rolls engine was running absolutely perfectly, the aeroplane was making no other complaints at all, and Grieve and I were happy and warm enough although the weather was so unkind.

At about 11.30 I determined that something had got to be done to keep the water temperature down, and had already reached the conclusion that the most probable cause was a collection of rust and odds and ends of solder and so forth that had shaken loose in the radiator, and were stopping up the filter which prevents any solid substances from getting into the pump.

Very often one can get rid of this sort of stoppage by stopping the engine and nose diving, so giving the accumulation a chance to spread itself and the filter to clear, with the rust and dirt at the bottom edge of it and not all over it. At any rate, there was nothing else to do, so down went her nose and we dropped quietly from 12,000 to about 9,000 feet. I then started the engine up again, and

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was tremendously relieved to see that the temperature kept moderate although we were soon climbing again. But all the same our anxiety was not to be put aside, because if we had to do the clearing process often it meant that we should waste a lot of petrol, which with the wind a good deal against us we certainly could not afford to do.

An hour later, 12.30 p.m., the thermometer had returned to 175 degrees F. We were now about 800 miles out, and the weather had shown no signs whatever of improving, so that we were forced into continuing our cloud dodging tactics. Down went the nose again, but this time our luck did not hold, and when we started to climb up the temperature rose perilously close to boiling point. So we tried again, but things only got worse instead of better, and very soon the water started boiling in earnest.

We had nineteen gallons in the engine, but she was pulling about 200 horsepower and once she started boiling, in spite of the intense cold—the atmosphere was getting on for zero—I knew it would not take long for the water to evaporate. After the second time of asking unsuccessfully I got the machine up to 12,000 feet and throttled her down, so that she would just about stop at that altitude so as to give the water every chance. The top plane was covered with ice from the radiator, and the steam was spouting out like a little geyser from a tiny hole in the middle of it. But for some little time we were able to keep the temperature just a little below the fateful 212 degrees.

There was now not much difficulty about keeping a course, for the moon was well up, and our 12,000 feet took us above most of the clouds, so that now and then Grieve was able to take an observation on the stars which peeped out through gaps mostly to the northward. But about 6 o'clock in the morning we found ourselves confronted with a bank of black clouds as solid as a range of mountains and rearing themselves up in fantastic and menacing formations. They were at least 15,000 feet high, so it was obviously useless to try and get over the whole lot, but when we couldn't fly round them—going through them was out of the question

after we had had one try at it—we had a shot at going over some of the lower ones, but each time we rose the water temperature rose too, and furious boiling set in. So it was no good going on with that scheme.

In the meantime I had had no other trouble whatever in flying the machine. With the aid of the few stars we saw occasionally she was quite easy to trim, and when we got engulfed in the blackness of the clouds every now and then one was able to keep her level with the compass and the bubble.

Very reluctantly we came to the conclusion that as we couldn't go up we should have to come down, so we descended to about 6,000 feet at about 6 a.m. Here it was blacker than ever, so down we went further and at about 1,000 feet found things a good deal brighter with the cheerful sun just getting up to help us on our way.

Grieve's observations on the stars had shown that we were now on our course and well in the 'Steamer Lane'.

Water that constantly boiled even at 1,000 feet did not help matters, and what showed us that we had really lost a great deal (if only we could have slung a bucket overboard and picked up a few gallons as we went along!) was the fact that in our drop down we had had a very narrow squeak indeed. No sooner had the engine stopped than it must have gone stone cold owing to the small amount of water in the jackets, though steam was coming out of the radiator relief pipe quite merrily for some little time. This fact we had not realised until when quite low down I opened the throttle and got no response whatever.

I then shouted to Grieve to get busy on the petrol pump, and he was very soon bending forward and pumping hard enough to push the carburettor needle valves right off their seats and flooding the jets with petrol.

But nothing happened at all except that the Atlantic rose up to meet us at rather an alarming rate. We were gliding down wind at a pretty good speed, the sea was very rough, and when we hit it I knew very well that there was going to be a crash of sorts, and that if he remained where he was Grieve would probably get

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badly damaged, as he would be shot forward head first on to the petrol tank. So I clumped him hard on the back and yelled to him that I was going to 'land'.

We were then about 10 feet above the particularly uninviting-looking waves.

And then we had the biggest stroke of luck.

Thanks to Grieve's pumping the engine at last fired, I gave her a good mouthful of throttle, she roared away with the best will in the world, the dive flattened and tilted into a climb and we were soon back again at a four-figure altitude and very glad to be there.

Had we hit the water we should have had not the slightest hope. Probably we would have been hurt owing to our speed with the wind, the aeroplane would have been badly damaged, and it was ten to one that if we had had sense enough left to launch the boat we shouldn't have been able to use it, and there was every probability of it being all over with us pretty quickly. I for one do not want a narrower shave.

By this time we had come to the conclusion that nothing could be gained by going on; we could still fly for an hour or two with what water we had left, but to get to Ireland was no longer within the range of practical politics; we had plenty of petrol, but the expenditure of water was what was critical. We now decided shortly after 6 a.m. to wander round in search of a ship. For this purpose we steered a sort of zigzag course, dodging the clouds and squalls of rain, and keeping down low owing to the clouds. If we didn't spot one, then we had simply got to make the best landing we could, launch the boat, touch off our big Holmes flare which would last for an hour at least, and hope for the best. We also had plenty of Very lights to fall back upon, and if it had got to be a long job we had plenty of food for we had scarcely touched any on the flight beyond drinking a fair amount of coffee and munching chocolate. Neither of us as a matter of fact had felt like eating at all.

We flew around for some two hours or so in weather that was getting a good deal worse rather than better. There was no lack

of rain squalls, the wind was getting stronger and gustier and bumpier every minute, and the sea rougher. I was very glad to be without the undercarriage, and would rather have been as I was than have floats under me, for the waves looked too heavy for any ordinary seaplane to stand.

As may be imagined, I was not altogether without anxiety although I knew we were right on the steamer route, to which we had taken care to shape our course, because there was plenty of fog, and we might have passed quite close to a ship without seeing her.

Suddenly a hull loomed out of the fog and we knew that our luck, if it had been patchy, was at least good enough to stand up when the big strain came on it. I am ready to admit that I shouted with joy. Grieve says he felt like doing the same thing, but evidently the tradition of the Silent Service (to which he is an ornament) was too much for his vocal chords.

The hull belonged to the good ship *Mary* of Denmark, and she was sailing towards, for us, home. We flew around her and fired three Very light distress signals and kept close by until her crew began to appear on the decks. Then we pushed off a couple of miles or so along her course, judged the wind from the wave crests, came round into it and made a cushy landing in spite of the high sea that was running. The machine alighted quite nicely and, thanks to her partly empty tanks, rode clear of the water, although now and then the waves sloshed right over it and us and soon played havoc with the main planes.

However we had no difficulty in detaching our little boat and getting it launched, for the machine was sinking pretty fast, although we did not expect it would be likely to go down altogether.

Our life-saving suits worked splendidly and kept us quite dry. The *Mary* was soon close up to us and made speed to get a lifeboat out, but although she was only two hundred yards off it was an hour and a half before she could get to us and take us off. They had run a line out to the boat from the ship and we were soon hauled in. Owing to the heavy sea it was impossible for us to salve

Our Transatlantic Flight

anything, but as we now know a good part of the machine and the mail bag was afterwards picked up by the *Lake Charlotteville* and brought into Falmouth, so that our letters got delivered after all.

We were picked up on Monday at 8.30 p.m. Greenwich time (9.30 a.m. British summer time), fourteen and a half hours after we had started from Newfoundland.

Neither Grieve nor myself can possibly find words to express our deep gratitude to Captain Duhn of the good ship *Mary*. His men had extreme difficulty in taking us off, and we owe our lives to their gallantry, for there is no doubt that, as Captain Duhn said, in another hour we should have gone down for keeps.

We had hoped to fall in with a ship equipped with wireless so that we could communicate with our people in England, and of this Captain Duhn, who spoke excellent English, thought we had a good chance, but later on the storm got considerably worse and he had to heave to, only making very little way in a northerly direction and so going further away from the busier shipping route. So it was not until we were off the Butt of Lewis that we could communicate with home and the world that at one time had seemed so distant.

The destroyer *Woolston* picked us up outside Loch Erriboll and took us to Scapa Flow, where we received a wonderful welcome from the Grand Fleet and Admiral Fremantle.

The next day we were put on terra firma and made the best of our way home. As to the reception we received and the demonstrations that were made, need I say that Grieve and I were more than deeply touched. We are completely agreed that the whole of this business was utterly undeserved and out of all proportion to what we had tried—and failed to do.

The men who should have the reception are Raynham and Morgan, for what they did was a magnificent act of pluck. The east-north-east wind was not by any means a bad one for our getting off, for it suited our aerodrome pretty much as well as any other and better than most, but it was almost the worst

Earlier Venture

possible wind for the Martinsyde aerodrome. But knowing this Raynham and Morgan never hesitated to attempt the flight, and in doing so they displayed a spirit and a courage for which Grieve and I have nothing but the most intense admiration and respect. They were visited with cruel hard luck indeed.

APPENDIX

The Rolls-Royce Aero Engine

Letter from Mr. Johnson, Managing Director, Rolls-Royce, to the Financial Times, 16th June, 1919.

The crowning triumph for the Rolls-Royce aero engine is the first direct Atlantic flight, accomplished in 15 hours 57 minutes on a Vickers Vimy 'plane. Not the least remarkable part of the feat is the high average speed maintained—namely, 117½ miles an hour. Evidently the two Rolls-Royce engines fitted to the Vickers Vimy 'plane must have worked perfectly throughout the 1,880 miles flight.

We have received the following telegram from Captain Alcock, D.S.C., and Lieut. Whitten Brown, the pilot and navigator respectively:

Congratulations on the performance of the two 'Eagle' Rolls-Royce engines which propelled the Vickers Vimy safely across the Atlantic.

To-day the Rolls-Royce factory at Derby is closed in recognition of the part which the workers took in making these now historical engines.

It has been calculated that if the Atlantic crossing were completed in 20 hours by one Rolls-Royce engine running at an average of 1,800 revolutions per minute, its performances would be as follows (in a two-engined 'plane such as the Vickers Vimy the operations would naturally be doubled):—Each engine will make 2,160,000 revolutions, and each piston will travel up and down the interior of its cylinder a total distance of 440 miles. As the Rolls-Royce engine has twelve pistons, they will in all travel 5,280 miles. The valves will be operated some 25,920,000 times in each engine, the magnetos and sparking plugs having to deliver the same number of sparks for the ignition of each engine.

Appendix

Recent history of the Rolls-Royce aero engines discloses one or two astonishing facts, thus:—

On 11th November, 1918, when armistice was declared there were in possession of the Royal Air Force Rolls-Royce aero engines of a total horse-power of over 1,000,000, which far exceeded that of any other make of aero engine in use. Previous to armistice day (11th November, 1918) there had been constructed 122 Handley-Page 'bombers', of which no less than 113 were fitted with Rolls-Royce engines. Prior to the same date 1,524 complete 'Bristol Fighters' had been delivered, of which number 1,364 were also equipped with Rolls-Royce engines. Rolls-Royce engines were used exclusively in the planes of the London-Paris Government courier service for the conveyance of Ministers, officials and dispatches to and from the Peace Conference, the speed record between London and Paris—namely, 75 minutes—standing to the credit of the Rolls-Royce aero engine. The only two aeroplanes which have flown from England to India were both fitted with Rolls-Royce engines.

The extracts from *The Times* of 16 June 1919 which occur earlier in this book are reproduced by kind permission of the Editor.

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DISCARD



Captain John Alcock with the McEvoy
portrait of his brother.

Captain Alcock, who has contributed the introduction, is the younger brother of Sir John Alcock who inspired him to fly. He is a distinguished flier in his own right and holds the world record for flying hours as a pilot both in the R.A.F. and in B.O.A.C.

